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# RADIO & TELEVISION NEWS

MAY 1955
15 cents in U.S. and Canada

World's Leading Electronics Magazine

IN THIS ISSUE

IT'S TIME FOR PORTABLES

CAMPUS CARRIER-CURRENT SYSTEM

144-148 MC. HANDIE-TALKIE

TRANSISTOR PREAMP

HOW GOOD ARE MODERN TV SETS

SHRINKING TV PICTURES

V.H.F.–U.H.F. TV SEPERATOR

HI-FI SYSTEM SWITCHING

VARIABLE LOW-PASS FILTER

AN R/C RECEIVER FOR MODEL BOATS
(See Page 44)





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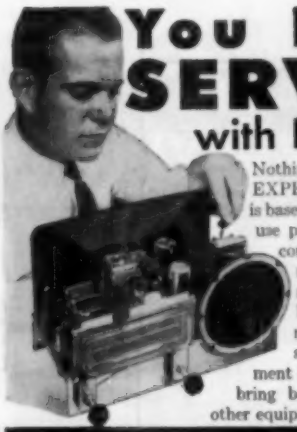
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J. E. SMITH, President
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*Editor and Asst. Publisher*
OLIVER READ, D.Sc., W1ETI

*Managing Editor*
WM. A. STOCKLIN, B. S.

*Technical Editor*
H. S. RENNE, M. S.

*Service Editor*
CHARLES TEPPER

*Associate Editor*
P. B. HOEFER

*Assistant Editor*
J. JUSTER

*Television Consultant*
WALTER H. BUCHSBAUM

*Art Editor*
FRANK SAYLES

*Draftsmen*
A. A. GANS, W2TSP
J. A. GOLANEK

*Advertising Director*
L. L. OSTEN

*Advertising Manager*
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COVER PHOTO: A reliable radio-control receiver adds to the pleasure of operating model planes and boats. With the advent of summer, try building the R/C receiver on page 64. (Ektachrome by J. Hilmanowski)

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## CONTENTS — MAY, 1955

| | | |
|---|---|---|
| Campus Carrier-Current System | *Philip J. Kiser* | 35 |
| A Practical Transistor Preamp | *Bernard Edelman* | 39 |
| Controls for Your TV Receiver (Part I) | *Esmond E. Johnson* | 40 |
| Decibel Conversion Nomograph | *Charles S. Kimball* | 42 |
| It's Time for Portables | *Bill Bouie* | 43 |
| A Variable Low-Pass Filter | *Lawrence Fleming* | 46 |
| 144-148 mc. Handie-Talkie | *H. F. Priebe, Jr., W2TGP* | 48 |
| Hi-Fi System Switching | *William Vissers* | 50 |
| A Two-Band Final | *R. H. Mitchell, W5DWT* | 51 |
| A Most Unusual Oscillator | *Harold C. Hubbard* | 52 |
| Germanium Diode Oscillator | *Irving Gottlieb* | 55 |
| Shrinking TV Pictures | *Sol Heller* | 56 |
| Certified Record Revue | *Bert Whyte* | 58 |
| How Good Are Modern TV Sets? | *Walter H. Buchsbaum* | 59 |
| An Integrated Hi-Fi Amplifier | *Edw. S. Miller* | 62 |
| An R/C Receiver for Model Boats | *Peter J. Vogelgesang* | 64 |
| V.H.F.-U.H.F. TV Generator | *Bruce A. Morrissette* | 66 |
| "Missionary Voice in Haiti" Marks Anniversary | *Kenneth R. Boord* | 70 |
| Mac's Radio Service Shop | *John T. Frye* | 74 |
| Financing Your Business | *David Seiler* | 82 |
| A Simple Bias Supply | *Bruce F. Brown, W6TWW* | 110 |
| Radio-TV Service Industry News | | 126 |
| New TV Grants Since Freeze Lift | | 142 |
| New TV Stations on the Air | | 142 |
| Electronic Timer for Photo Enlarger | *Doris & Daryl Wiley* | 144 |

### DEPARTMENTS

| | | | |
|---|---|---|---|
| For the Record ..... *The Editor* | 8 | Sales Aids | 117 |
| Spot Radio News | 16 | What's New in Radio | 131 |
| Within the Industry | 24 | Manufacturers' Literature | 148 |
| Technical Books | 76 | New Audio Equipment | 154 |

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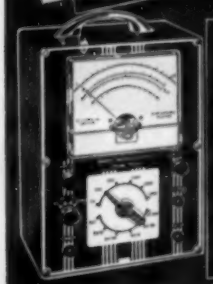






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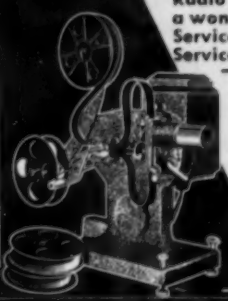
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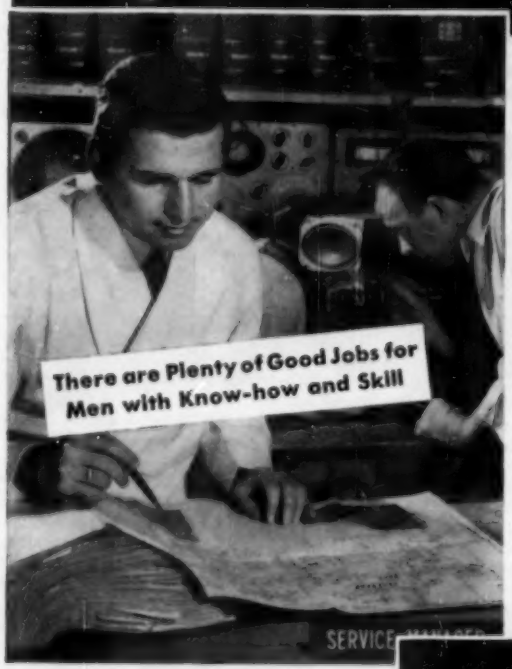
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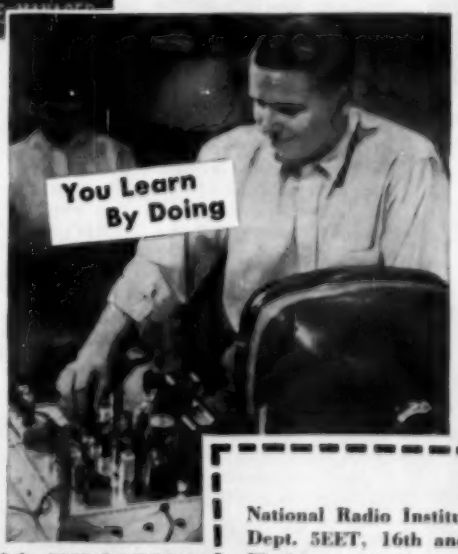
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# For the RECORD

BY THE EDITOR

## TECHNOLOGICAL REVOLUTION

AMERICA has long been described as "the land of opportunity," and indeed it is. Today, more than at any other time in the history of radio, television, and electronics, are there numerous and promising opportunities for youth to enter the fastest-growing of all the world's major industries.

It is unfortunate, we feel, that in this age of technological achievement and progress that so few teen-agers are encouraged at school level to examine the tremendous possibilities in the fields of science—particularly electronics. Educators are failing to encourage these teen-agers in things technical, but are devoting their efforts in educating youth to study other arts which, in the future, do not possess the practical advantages of an expanding industry.

Our country was known many years ago for its craftsmen. Today it is comparatively rare to find one skilled in things mechanical which, by comparison, are more profitable as a vocation than numerous other arts commonly taught in our high schools. In spite of the tremedenous growth of electronics, its opportunities apparently are overlooked by the educators. This, in spite of the fact that today electronics is and will continue to be the fastest-growing industry of our times. It takes no crystal gazer to realize that the electronics industry will probably more than double its growth within the next ten years.

Recently, your editor visited his local high-school at a regular P.T.A. meeting to see the "end products" of various classes—including the arts. Instructors, without exception, took great pride in displaying pottery, glassware, oil and water-color paintings, cartoons, pen and ink sketching, etc., to name but a few. But nowhere could we find evidence of any scientific instruction like electronics that offered a real opportunity for future employment for the average student. We don't mean to imply that no opportunities exist in the other arts. But compared to electronics, they are indeed most limited. We feel that the educators are failing miserably to foresee and to analyze the great opportunities presented by the fastest growing of all the world's major industries—electronics.

Our government has recognized the weakness of our educational system in its failure to supply potential scientists and engineers for its vast defense system, and even without the opportunities for a bright future in military electronics there also remains a vacuum of talent in all of the scientific fields. Our industry is said to have only 25% of essential technical know-how, and points with alarm to our potential enemy and its progress in scientific educational development. Electronics, as an industry, has expanded at a rate that almost defies comprehension. To many it is still a magical term.

It's the old story of the three blind men and the elephant. The one who felt the trunk described it as an animal built like a tree; the one who patted its side thought of it as built like a door; and the one who grabbed the tail said it resembled a snake.

It could hardly be otherwise. Electronics is today a highly complex industry because of the many miracles that it can perform in the home, in industry, and in commerce. Youth does not realize, for example, that the entertainment end of the industry comprises but a fraction of its over-all productivity and application. The field of industrial electronics, as one example, will some day reach proportions that may dwarf either military or entertainment electronics.

Our friends in Canada have made tremendous progress in electronics during the past few years. Interest has been reflected in our own growth across the border. We talked to many visitors to the recent IRE convention in New York and, without exception, these Canadian engineers wholeheartedly agreed that equal opportunities exist in the Canadian electronics industry for new blood. Hi-fi is booming, we are told.

As you read this editorial, I will be in Toronto to visit their 2nd annual Audio Show and to later report on our observations of Canada's expanding electronics industry.

Numerous opportunities are available to youth in the field of electronics, but he cannot possibly seize upon these opportunities unless he is first encouraged at school level and, accordingly, to understand and consider its advantages. And it is logical to assume, we think, that if the educators would encourage and teach electronics subjects that they would make an outstanding contribution in the prevention of juvenile delinquency. This is so because electronics, compared with other fields of endeavor, is able to offer not only a lucrative *vocation* but, of equal importance, has its well-known *avocations* including the hobbies of amateur radio, high-fidelity, model control, and a host of other interesting pastimes.

Here we think is a very real opportunity for educators to use a bit of common sense in designing a curriculum that would serve a positive purpose—one that would result in future security for millions of teen-agers.

We would like every teen-age boy in high-school to read the following from a recent speech by *W. Benton Harrison*, of *Sylvania Electric Products Inc.*, in which he states: ". . . from the standpoint of sales and revenues, the electronics industry is today virtually a $9,000,000,000 industry. In the three-year period, 1958-60, total sales will come close to $14,000,000,000 a year. And, ten years from now, in 1964, we are positive we will be justified in calling electronics an industry with sales and revenues totaling over $20,000,000,000 a year. . . .

"I repeat, today electronics is a $9,000,000,000 industry; by 1960 it will be a $15,000,000,000 industry; and by 1964 it will be a $20,000,000,000 industry. That means that within a decade it will have more than doubled its present size. It is extremely difficult to envision any other major industry that will grow that fast between now and 1965."

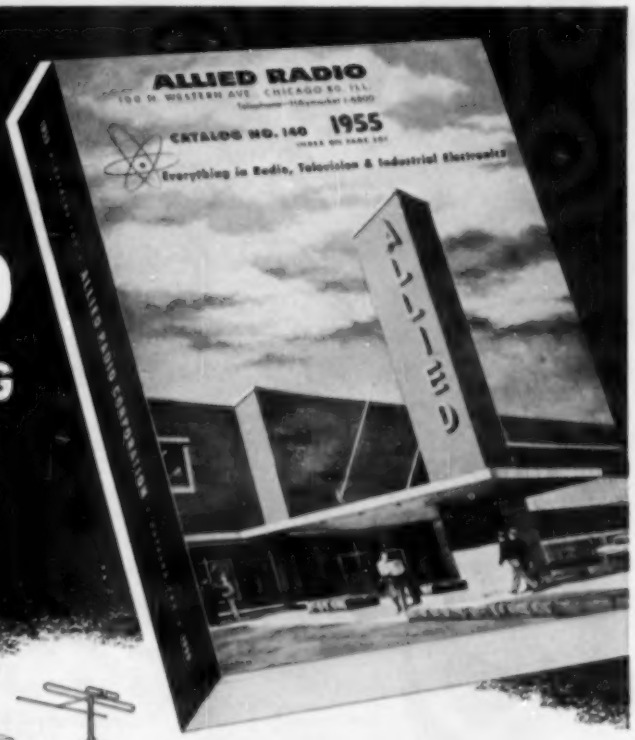
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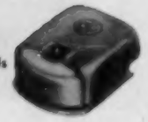
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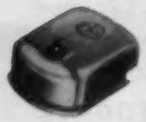
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**The 220 and 240 are engineered to maximize performance. By comparison they are without equal . . .**

*The* **220** *and* **240** *are*

**Lighter—5½ grams**

**Smaller—⅝ by ¾ by ⅜ inches**

*The* **220** *and* **240** *have*

**Highest Output—30 millivolts/10cm/sec.**

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*These characteristics have real meaning to those who understand that maximum performance depends upon components which meet professional standards. If you want the best that high fidelity can offer, ask your dealer to demonstrate the 220, 240 and 260 Pickering cartridges . . .*

*The Most Nearly Perfect Phono Pickups Ever Produced*

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**PICKERING COMPONENTS ARE PROFESSIONAL QUALITY**

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J. C. Lane, B.S., M.S.
President, Radio-Television Training Association
Executive Director, Pierce School of Radio & Television

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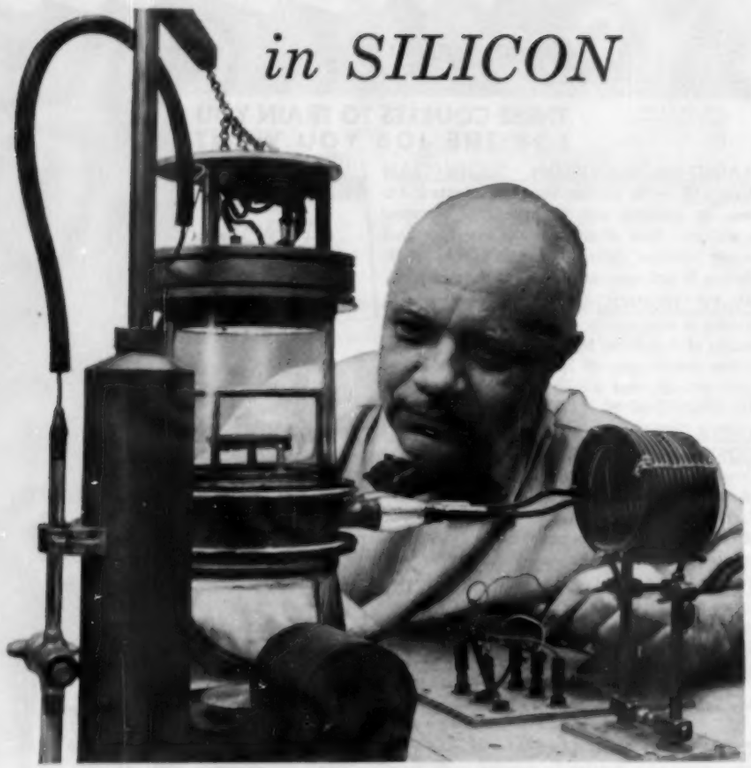
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*in SILICON*



*One example of junction technology at Bell Laboratories. Here a junction is produced on the surface of silicon by bombardment with alpha particles. Bombardment enhances silicon's performance at very high frequencies.*

One day in the 'thirties a revolutionary adventure began for Bell scientists. They were testing an experimental silicon crystal they had grown to make microwave detectors.

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Another Great Instrument in Philco's Complete Line of Test Equipment



MODEL 7300

PHILCO

Precision Alignment Generator

for Better Television and FM Radio Service

Speed up work on the bench or in the field . . . handle jobs more efficiently and make more profits! Every service man needs the Philco Precision Alignment Generator. A portable unit, versatile in application, it gives fast, accurate information for better TV and FM Servicing.

All necessary signals for servicing FM and TV receivers are supplied by this compact instrument. Intermediate frequencies and channel frequencies are covered in two ranges by the sweep generator. Three ranges, from 3.2 MC to 260 MC may be tuned in with the Marker Generator, and this function can be used to supply marker pips for use with the sweep generator or as an AM generator with 400 cycle modulation.

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PHILCO TUBES IMPROVE THE PERFORMANCE OF ANY TV OR RADIO RECEIVER

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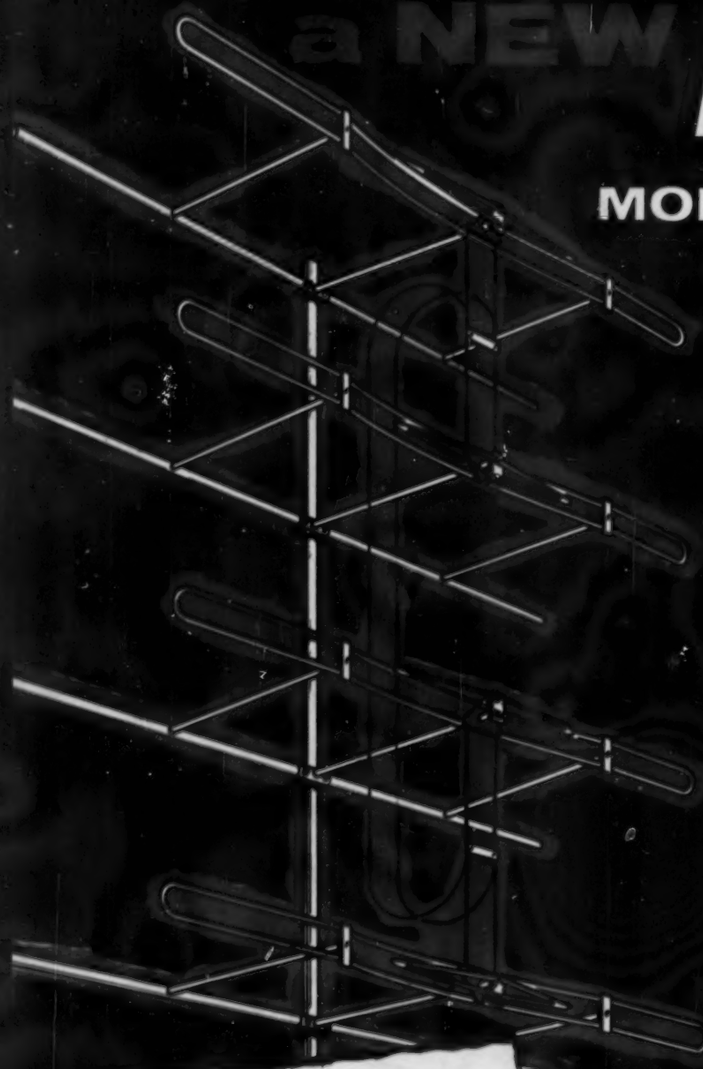
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PHILCO Quality

# ANNOUNCING a NEW FINCO® MODEL F-4

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with exclusive

## FIDELITY PHASING*

* Dictionary: the highest degree of accuracy in the reproduction of a signal

Plus +

**Now!**
**Finest Performance Ever Achieved on LOW-BAND**

**Acknowledged FINCO Superiority on HIGH-BAND!**

# "We will stake our reputation on this!"



M. L. Finneburgh, Vice-President, The Finney Company, speaking for the entire FINCO organization:

**"The new Finco Model F-4 (pat. pend.) is the closest approach to perfection yet conceived in TV antennas. The F-4 gives the greatest combined performance ever achieved in the Super Fringe Area . . . on both Low and High-band. Upon this, we stake our reputation."**

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- LOW AND HIGH-BAND SUPREMACY
- ENGINEERED FOR COLOR
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**WRITE, WIRE OR PHONE TODAY!**

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For military requirements, insist on Peerless transformers for QUALITY design and QUALITY manufacture that insures constant QUALITY control.

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# Spot Radio News

**☆ Presenting latest information on the Radio Industry.**

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

THE TANGLED V.H.F.-U.H.F. situation received another encyclopedic review a few weeks ago; this time from the Republican member of the Senate Interstate and Foreign Commerce Committee, Robert F. Jones, serving as special counsel to the group. Like the Plotkin (representing the Democratic faction) edict, this essay was also extremely critical of dozens of decisions that have been made by the Commission and industry.

Reviewing the ultra-high problem, Jones said that it does not appear ". . . practical that the television industry and the public would accept any plan to drop v.h.f."

The former FCC member viewed past actions of his colleagues as serving to accentuate, rather than alleviating . . . "the economic and operational difficulties of u.h.f. telecasting, as compared with v.h.f. . . ."

Noting that the Commission has permitted satellite operation of high-band stations by low-band operators, he said that if these older stations, now located in the larger markets of the nation, use their new satellites to extend their service areas . . . "then indeed u.h.f. individual operators will have a further economic hurdle thrown in their paths to compete with v.h.f. stations for the sale of their broadcast time."

The pending proposal, to double maximum antenna heights (1000 to 2000 feet), would in the former Commissioner's opinion further lessen the chances for successful u.h.f. operation. As a matter of fact, he said, any . . . "increase in antenna height of the proposed magnitude would substantially increase the size of the v.h.f. service area, and act as a halter to successful operation of any u.h.f. station."

Pointing out the future of the high bands lies in economics, Jones said that no amount of . . . "dogged determination on the part of Congress will repeal the economic facts upon which it must rise or fall."

Hitting the allocation plan as the core of the trouble, the Washington attorney said that v.h.f. operators simply had too much time to build up their systems and as a result promote the purchase of too many millions of low-band sets. And even after the freeze went, he added, only low-power u.h.f. stations appeared, and so the march to v.h.f. continued.

"No amount of wishful thinking or executive fiat will remove these differences . . . until there is a circulation of u.h.f. receivers," declared the Senate's counsel.

Continuing his withering attack against the Commission, Jones said that during the freeze, the FCC found a means of . . . "mitigating the effect of interference by offsetting the carriers of each adjacent-co-channel station, and it established new interference curves, based upon new desired-to-undesired signal ratios. However, it (the FCC) used the new technique (offset carrier and the new interference information) to overcome every difficulty of the v.h.f. channel (frequency) characteristics (attainable immediately), and then it fixed unrealistic values for u.h.f. channels which could not be exploited competitively by u.h.f. operators immediately or in the forseeable future."

In conclusion, the members of the investigating committee were told that no sentiment . . . "on the part of Congress or the Commission in behalf of u.h.f. will repeal the law of economics operating in our private enterprise system . . . V.h.f., by virtue of its early start, has moved into the larger markets and saturated such markets and surrounding rural areas with v.h.f.-only receiving sets . . . It follows that the larger concentrated masses of population now and hereafter will need only v.h.f.-only sets and that the unit costs will always favor v.h.f.-only sets and work against any mass production to cut costs on all-channel receivers."

THE WONDROUS DEVELOPMENT of the nation's electronic experts received a dramatic unveiling a short while ago, during a gala open house for two labs of the Bureau of Standards in Washington.

In a talk before distinguished guests, the director of the bureau, Dr. Allen V. Astin, described and demonstrated an ingenious device for x-ray televising of the interior of an engine. Highly-penetrating radiation from a betatron, in combination with a technique recently developed at the Bureau for converting high-energy x-rays into visual images, were used. The audience saw clearly a moving piston, piston rod, and other parts in the televised x-ray image of the engine; a one



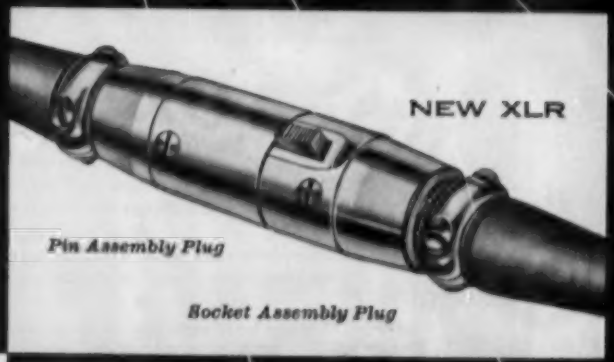
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**XLR** is the designation of Cannon's **all new** audio cord connector . . . the most modern addition to the long line of distinguished Cannon Connectors featured on all top-quality microphones. It's really **quiet,** too!

New resilient insulator and specialized construction of socket contact assembly protects against disagreeable mechanical interference . . . noise problems encountered with many other type connectors when their cables are moved, pulled or subjected to shock.

Features streamline design, bright nickel finish, integral cable clamp, neoprene cable relief, and the time-tested Latch-Lock that Cannon pioneered on the first audio connectors. Available with three 15-amp. or four 10-amp. contacts. Available in panel receptacle type, providing same continuous characteristics.

Available from distributors everywhere, or from the factory in production quantities.







*first in connectors*

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Big brother to the famous "Largo 8"



**New, complete two-way speaker system —**
*with all the time-tested, proven features of the "Largo 8"*
**plus:**

- **More powerful Super Royal 12" Speaker**
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- **Full 20-watt power-handling capacity**
- **Smooth peak-free response . . . 30 to 16,000 cycles**

**Combined with:** • Scientifically matched 32KTR Super Tweeter • Slanted speaker panel for proper sound focusing • High-frequency balance control • Horn loading of back wave thru unique cabinet base. The Largo 12 is precision-constructed of beautiful ¾" Mahogany or Korina Blonde cabinet woods. Impedance, 8 ohms.
Size: 23⅛" H, 27½" W, 15½" D.

**Audiophile NET.....$149.50**
(Also available in Walnut at slightly higher price.)

HTP. The Largo 12 is available under the exclusive Permoflux Insured Home Trial Plan (HTP). Try it in the comfort and quiet of your own home for 15 days—with your own records and associated equipment. *For a limited* time only, each HTP participant will receive—absolutely FREE—the new Permoflux "Maestro" speaker-Headset Control Box ($10.00 value). Also available under HTP: the Diminuette ($49.50); the Largo 8 ($99.75).

Only Permoflux gives you all the features you should have in a 2-way high-fidelity speaker system. See and hear the Largo 12 and other Permoflux systems at your hi-fi dealer today. Also ask him about HTP—or write:

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cylinder affair. By means of this technique, it is said that it should be possible to televise the internal operation of a wide range of mechanisms, such as automotive and aircraft engines, pumps and so on.

Because of their greater penetrating power and lower scattering, high-energy x-rays from betatrons and synchrotrons produce sharper images than do lower-energy x-rays, allowing observation of greater detail and detection of more minute flaws in metallic equipment.

The new system makes use of an instrument called a pattern amplifier, which acts as an x-ray intensifier, continuously detecting, amplifying, and displaying low-intensity x-ray images. The major component of the amplifier is a converter; a large cylindrical, thallium-activated sodium iodide crystal, which converts x-ray images into optical images. When bombarded with an x-ray beam, the crystal emits visible light. If the flat faces of the crystal are perpendicular to the x-ray beam, a visible replica of the x-ray image may be observed along the beam axis. When the pattern amplifier is used in conjunction with a high-intensity, high-energy x-ray source such as the synchrotron, it can continuously display images of parts hidden by as much as eighteen inches of steel or seven and a half feet of concrete. The visual image may be detected in several ways. It may be observed directly by eye, photographed with an ordinary camera, or observed with a remotely-controlled television camera.

Discussing the Bureau's radio range, Dr. Astin said that they are working with the Air Force and Navy Bureau of Aeronautics to set up a recalibration center to insure the reliability and efficiency of electronic equipment in military aircraft. At this center, working standards, used in maintaining general equipment will be periodically recalibrated.

Also on demonstration was a three-color brightness standard, covering the reds, greens, and blues, used for the TV industry system.

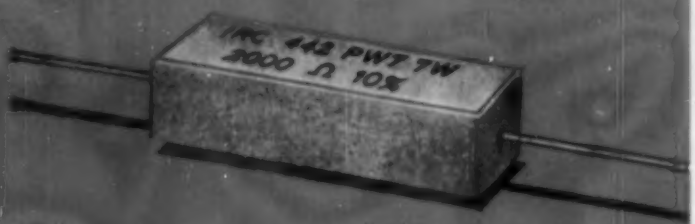
In addition, high-speed electronic computers and supersonic speed measurement devices were also demonstrated.

**A RESOLUTION** to amend House rules to permit broadcasting and televising of committee proceedings received quite a heated hearing during a recent session of the House Rules Committee.

Favoring open telecasting, Congressman Donald Jackson of California said that in his opinion TV was a major medium of information, and eventually public pressure will demand that Congress permit televising of perhaps all of its activities. Chiding his colleagues who insist on *acting* before the cameras, the Congressman said that such performances could well show up the ego of the Representatives and possibly affect their popularity and re-election.

(*Continued on page* 140)

NEW




Here are wire wound power resistors designed for today's servicing requirements. New, rectangular design is more compact. Famous IRC element is sealed in ceramic case for complete insulation and protection. Axial leads are easily soldered and speed replacement. Clear, permanent markings give full identification.

- 2 SIZES—PW-7 seven watts; PW-10 ten watts.
- COST LESS—new, low price for IRC Power Resistors.
- FULL POWER—Conservative ratings permit continuous operation at full power.
- NEW VALUES—in keeping with today's needs.

# WIRE WOUND POWER RESISTORS

*in handy Resist-O-Card Assortments*




IRC Resist-O-Cards are easier to buy, stock and use. Values are printed on each card — you always know what you have — and you always have what you need. Assortments are based on popular usage.

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Trade-in talk is not idle chatter when it concerns Walter's "Surprise" allowances on used (factory-built) test and communication equipment. Here's the real low down. You save money... lots of money. And that's the kind of plain talk any one with an eye for a bargain can understand. Better, wire, write, phone or use the handy coupon—right now!



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**JOHNSON VIKING KILOWATT POWER AMPLIFIER** for CW, AM and SSB. With tubes, wired and tested. Net $1595.00.

Accessory desk top and right or left hand pedestal. Net $123.50.

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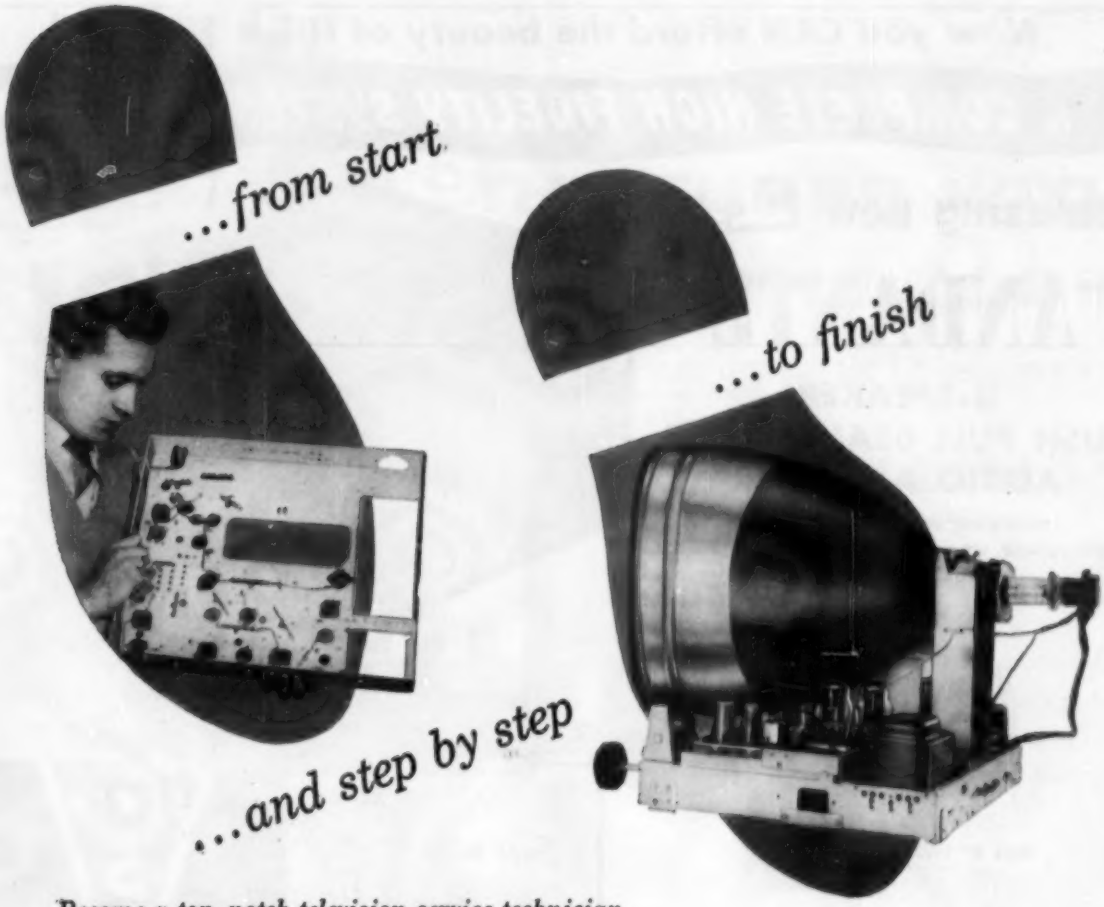
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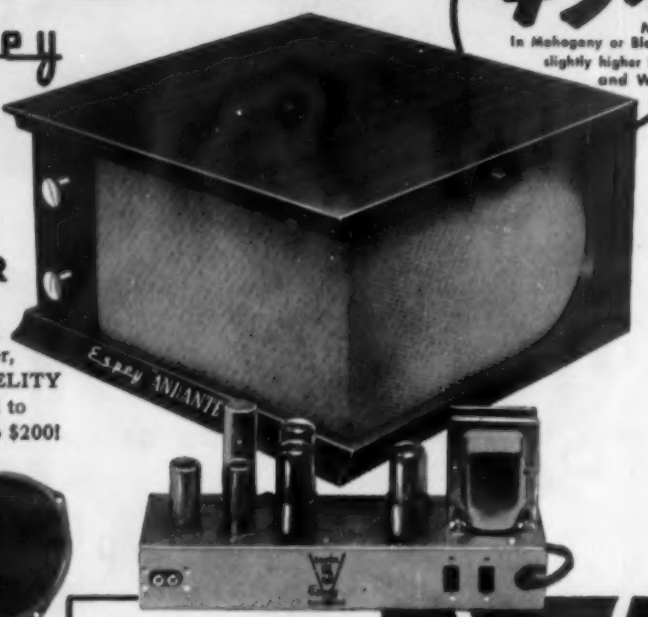
In Mahogany or Blonde slightly higher South and West

## amazing new Espey "ANDANTE"

### 3-SPEAKER PUSH PULL BEAM POWER AUDIO AMPLIFIER

makes any record player, changer, tuner, microphone, etc. into a SUPERB HIGH FIDELITY SYSTEM with performance equal to equipment costing $150 to $200!







***Only ESPEY PIONEER ENGINEERING could make possible the "ANDANTE". . .***

Since 1927 Espey has been a world leader in the design and manufacture of electronic and audio equipment of the highest precision. Espey engineers have long concentrated on the problem of attaining high-fidelity reproduction at a price within the reach of all—have finally developed the astonishing SUPER V-5 AUDIO CHASSIS.

### CUSTOM BUILDERS!

READY FOR MOUNTING ANYWHERE!

**SUPER V-5 ESPEY CHASSIS**

complete with 3 SPEAKERS $39.95 NET

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already baffled, plus escutcheon and knobs, LESS CABINET

***Look at all these almost-unbelievable quality features!***

- **PRECISION 5-TUBE AC-OPERATED PUSH-PULL BEAM POWER AMPLIFIER with power transformer.**
- **TUBE COMPLEMENT: 6X5GT, 12AT7, 12AX7, 2-6K6GT**
- **AUDIO DEGENERATION CIRCUITRY: special inverse feedback provides minimum distortion.**
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- **ONE SEPARATE HIGH-FREQUENCY SPEAKER: 4-inch, front-mounted.**
- **HIGH-FIDELITY VOLUME CONTROL: automatic frequency-compensated circuitry maintains proper amount of compensation for "highs" and "lows" at every volume level.**
- **FREQUENCY RESPONSE CONTROL: enables user to adjust tone response to individual requirement of "highs" and "lows".**
- **COMPLETE UNIT AUDIO RESPONSE: 40-15,000 cps.**
- **CAN BE USED WITH ANY STANDARD RECORD PLAYER (RCA, Webster, VM, Columbia, etc., as well as any Tape Recorder, Tuner, Microphone, etc.)**
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- **DUAL AC OUTLET for other electrical appliances such as lamps, etc.**
- **CHOICE OF BEAUTIFUL FURNITURE FINISH: Mahogany or Blonde — hand-rubbed, high luster.**
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***The "ANDANTE" is available at leading electronic parts distributors coast to coast. Write for name of distributor nearest you and free latest Catalog R-5.***

**Espey MANUFACTURING CO., INC.**
528 East 72 Street, N. Y. 21, N. Y.



# "I WANT THE TUBES WITH THE GOOD HOUSEKEEPING GUARANTY SEAL!"

"TV and radio tubes are mysterious things to me, but that Good Housekeeping Seal is a tried and true friend. I trust any product that has earned it. So when you replace tubes in *my* sets, be sure they're CBS tubes . . . *the tubes with the Good Housekeeping Guaranty Seal.*"

REPLACEMENT OR REFUND OF MONEY
**Guaranteed by Good Housekeeping**
IF NOT AS ADVERTISED THEREIN




## Check and Remember

1. It's a *woman* you talk to on most service calls.
2. CBS is addressing its national advertising especially to women.
3. 53% of *all women* are influenced in their purchases by the Good Housekeeping Guaranty Seal.
4. CBS tubes have that Seal.

*Use CBS tubes . . . the tubes in which women have confidence.*

Millions will see or hear about CBS tubes on TV and radio . . . and in national magazines throughout 1955.

**GET YOUR NEW**
**CBS Tube *SALES PROMOTION* KIT**

*Ask your CBS tube distributor for special offer . . . or mail $2.00 direct for complete Kit.*

CBS TUBES

**CBS-HYTRON,** Main Office: Danvers, Massachusetts
*A Division of* **CBS** *. . . the Columbia Broadcasting System, Inc.*

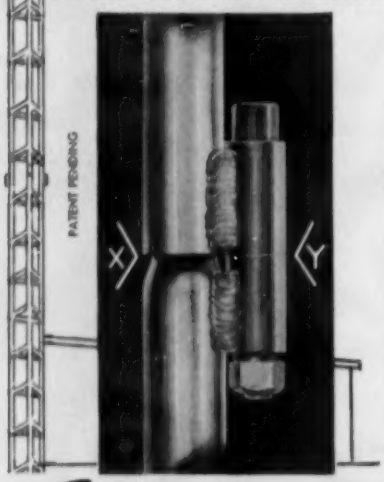
**A member of the CBS family:** CBS Radio • CBS Television • Columbia Records • CBS Laboratories • CBS-Columbia • CBS International • and CBS-Hytron

A TOWER OF STRENGTH

- Safe in gales up to 80 m.p.h. without ugly, hazardous guy wires
- Free-standing to 50 feet high
- No rusting, ripping or weakened holes
- Big, safe, steel gird-around ties
- Easy installation and dismantling
- Sturdy, safe . . . on roof or ground
- Thick, baked-on-steel aluminum finish

Kuehne *

TELEVISION TOWERS




*Exclusive!* LATERAL LOAD-BEARING JOINTS

*No dangerous rust.* Arrow "X" shows open-joint section. Moisture cannot get in tubing to cause interior rust.

*No hazardous holes.* Arrow "Y" shows lateral load bearers lifetime welded to side of each section leg with twin 1⅛" fillets. Sections are bolted vertically. Bear 100% of load! No load on joints. No horizontal bolts to tear through. Nothing stronger or safer. Only Kuehne has it!

KUEHNE MFG. CO.
TV TOWER DIVISION
MATTOON, ILLINOIS

* *Say "Kee Nee"*

For catalog sheets, see your "Kee Nee" Man or write direct.

# Within the INDUSTRY

**JOHN K. McDONOUGH,** until recently manager of *Sylvania's* radio and television division, has joined *General Instrument Corporation* as vice-president of its *F. W. Sickles Division* and director of sales for both the subsidiary and the parent company.



In his new post, Mr. McDonough will cover the sales of all products made at the company's six plants, *i.e.*, TV tuners, black-and-white and color TV deflection components, variable capacitors, auto radio tuners, and coils.

He was associated with *Sylvania* for more than ten years and has a wide knowledge of the radio and TV industry, both civilian and military.

* * *

**DON G. MITCHELL,** chairman of the board, has been elected president of *Sylvania Electric Products Inc.* to fill the vacancy caused by the recent death of **H. WARD ZIMMER . . . W. WALTER JABLON** has been appointed sales manager of *Radio City Products Co., Inc.*, and its affiliate, *Reiner Electronics Co. . . . Alpha Wire Corporation* has named **JACK KIRSCHBAUM** to the post of distributor sales manager . . . **EUGENE H. RIETZKE,** president of *Capitol Radio Engineering Institute,* was one of ten industry and government leaders to receive a Marconi Memorial Gold Medal awarded by the Veteran Wireless Operators Association. He was cited for his "outstanding contributions in the fields of technical education and electronics in all its phases" . . . **JOHN G. THOMPSON** has been named plant manager of *Heppner Manufacturing Co.* of Round Lake, Ill. . . . **CHARLES JACKSON PANNILL,** former president of *Radiomarine Corporation of America* and *RCA Institutes, Inc.*, who retired in 1947 after nearly half a century in radio communications, died recently in New York. He was 75 . . . *Andrew Antenna Corporation, Ltd.* of Whitby, Ontario, has named **RICHARD P. MATTHEWS** to the post of director of sales and engineering . . . **LEONARD F. CRAMER,** vice-president of *Avco Manufacturing Corporation* and general manager of radio and television for its *Crosley Division,* has resigned his post. His future plans have not been announced . . . **RICHARD F. GOETZEN,** sales manager of *Fidelitone* and *Permo Point Divisions* of *Permo, Inc.*, passed away recently . . . **IRVING GREENE** has resigned his post as vice-president of *Asco Sound Corporation* and joined *University Loudspeakers, Inc.* as advertising and sales promotion manager . . . **HARVEY FINKEL** has joined *JFD Manufacturing Company, Inc.* as general production manager. He is the seventh son of **JULIUS FINKEL** to join the firm . . . **SAM F. ARN** has been named engineering sales manager of the technical products division of *Packard-Bell Company . . . Rola Company, Inc.* of Cleveland, has appointed **JOHN ADAMS** to the post of sales manager . . . **NELSON P. MARSHALL** has been appointed general sales manager for *Sola Electric Co.* of Chicago . . . *National Company, Inc.* has named **EUGENE F. GRANT** to the post of director of engineering. The firm also announced the appointment of **ROBERT J. MURRAY** as manager of its service department . . . **CHARLES BUTCHER** has been promoted to the post of manager of the Newburyport, Mass. plant of *CBS-Hytron* . . . **JAMES M. BENNAN,** president and chairman of the board of the *Jefferson Electric Company,* was killed recently in an automobile accident. He was 44. His brother, **EDWARD J. BENNAN,** has been elected president to succeed him while **LOUIS J. CROSS** was named chairman of the board by the directors . . . **CHARLES H. GRIFFITH** and **JOHN M. ZIMMERMAN** have been elected vice-presidents of *International Resistance Company* by the board of directors . . . *C.G.S. Laboratories, Inc.* has named **MELVIN L. JACKSON** a vice-president of the firm . . . **NATHAN CHIRELSTEIN,** chairman of the board of *Allied Electric Products, Inc.* and its division *Shelden Electric Co.*, passed away recently at the age of 55 . . . **LOUIS G. PACENT, JR.,** works manager of *Emerson Radio and Phonograph Corporation,* has been elected vice-president in charge of manufacturing for the firm . . . **FRANK J. HEALY,** a vice-president of *Sylvania,* has been elected a director of the company. He has been with the firm for 38 years.

* * *

**DOUGLAS C. LYNCH,** formerly executive vice-president of *Brush Electronics Company* of Cleveland, has been named president of the company.



He joined the company in 1952, having previously been head of the international operations of the *Crosley Division* of *Avco Manufacturing Corporation,* and later a senior staff executive of *Willys-Overland Motors, Inc.* He holds a degree in mechanical engineering from Tri-State College. From 1937 to 1947 he was associated with *Westinghouse* in a number of engi-

# ADVANCE! Raise your earning power—learn RADIO-TELEVISION-ELECTRONICS by SHOP-METHOD HOME TRAINING

## GOOD JOBS AWAIT THE TRAINED RADIO-TV TECHNICIAN

There is a place for *you* in the great Radio-Television-Electronics industry when you are trained as National Schools will train you at home!

Trained technicians are in growing demand at good pay—in manufacturing, broadcasting, television, communications, radar, research laboratories, home Radio-TV service, and other branches of the field. National Schools Master Shop-Method Home Training, with newly added lessons and equipment, trains you in your spare time, right in your own home, for these fascinating opportunities. OUR METHOD IS PROVED BY THE SUCCESS OF NATIONAL SCHOOLS TRAINED MEN, ALL OVER THE WORLD, SINCE 1905.

## EARN WHILE YOU LEARN

Many National students pay for all or part of their training with spare time earnings. We'll show you how you can do the same! Early in your training, you receive "Spare-time Work" Lessons which will enable you to earn extra money servicing neighbors' and friends' Radio and Television receivers, appliances, etc.

## MASTER ALL PHASES!



Get Master Shop-Method Home Training from an Established Practical Resident School with its own Training Shops, Laboratories, Studios — almost 50 Years of Successful Experience in Training Ambitious Men.

**We Bring National Schools To You!**




Superheterodyne Receiver



Signal Generator — Audio Oscillator — T.R.F. Receiver

**LEARN BY DOING**

You receive and keep all the modern equipment shown above, including tubes and valuable, professional quality Multitester. *No extra charges.*

**FREE! RADIO-TV BOOK AND SAMPLE LESSON!**

Send today for National Schools' new, illustrated Book of Opportunity in Radio-Television-Electronics, and an actual Sample Lesson. No cost—no obligation. Use the coupon now—we'll answer by return airmail.




**APPROVED FOR VETERANS AND NON-VETERANS**
Check coupon below

**Both Resident and Home Study Courses Offered!**

## National Schools Training is All-Embracing

National Schools prepares you for your choice of many job opportunities. Thousands of home, portable, and auto radios are being sold daily—more than ever before. Television is sweeping the country, too. Co-axial cables are now bringing Television to more cities, towns, and farms every day! National Schools' *complete* training program qualifies you in all fields. Read this partial list of opportunities for trained technicians:

**Business of Your Own • Broadcasting**
**Radio Manufacturing, Sales, Service • Telecasting**
**Television Manufacturing, Sales, Service**
**Laboratories: Installation, Maintenance of Electronic Equipment**
**Electrolysis, Call Systems**
**Garages: Auto Radio Sales, Service**
**Sound Systems and Telephone Companies, Engineering Firms**
**Theatre Sound Systems, Police Radio**
**And scores of other good jobs in many related fields.**

## TELEVISION TRAINING



You get a complete series of up-to-the-minute lessons covering all phases of repairing, servicing and construction. The same lesson texts used by resident students in our modern and complete Television broadcast studios, laboratories and classrooms!

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Send FREE Radio-TV Electronics book and FREE sample lesson. No obligation, no salesman will call.

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☐ Check here if interested ONLY in Resident Training at Los Angeles.
VETERANS: Give Date of Discharge _____

# The DYNAMŪ Story
## IS TOLD BY OUR CUSTOMERS

BREAK THE SOUND BARRIER FOR TAPE

*". . . DYNAMŪ head produced significantly less hum and tape hiss. . ."*

*". . . For the first time my tapes sound as good as my best records through my Hi Fi System. . ."*

*". . . Could extend useful frequency response 15 kc or more. . ."*

*". . . No audible distortion such as may be discerned during peaks of a phonograph recording. . ."*

*". . . No noise is detectable except with ear right against the speaker. . ."*

*". . . A phonograph record transferred to tape and played back is indistinguishable from the original. . ."*

*". . . It was a 'cinch' to convert my tape recorder with your well illustrated folders. . ."*

*". . . Can't tell the difference at 7.5" with DYNAMŪ and 15" with my professional recorder. . ."*

### DYNAMŪ DATA

- DIRECT magnetronic drive as in finest professional studio equipments.
- 1½/10,000 of an inch gap formed of pure electrolytic copper for highest efficiency and long life. The finest and narrowest gap ever available on any head.
- RECORD and REPRODUCE gaps a straight line from end to end within 2 wave lengths of light for exact reproduction quality from one recorder to another with lowest intermodulation distortion.
- Distortion—typical head: 100 cycles— .6% at 15db below tape saturation. 800 cycles— .35% as above.

**STANDARD GUARANTEE ON MATERIALS AND WORKMANSHIP**

*Illustrated Step-By-Step Instructions Furnished*




**The Great Names In HI FI Distribution Have DYNAMŪ for you**
*Ask your favorite dealer or write:*

**DYNAMŪ CONVERSION KITS**
**FOR YOUR PENTRON • REVERE RCA • WILCOX GAY • KNIGHT CONCERTONE • OTHERS**

DYNAMŪ MAGNETRONICS CORPORATION, Div. of the Maico Co. Inc.
Maico Bldg., Minneapolis, Minn.


neering, sales, and management positions, finally as assistant general manager of *Westinghouse International.*

*Brush,* a unit of the *Clevite Corporation,* manufactures electronic instruments, magnetic recording heads, and piezoelectric crystals.

* * *

**HUGO COHN** has been elected president of *Radio Receptor Company, Inc.,* succeeding Ludwig Arnson who is retiring from the post he has held for the past 31 years. Mr. Arnson will continue to serve the company as a director and consultant.



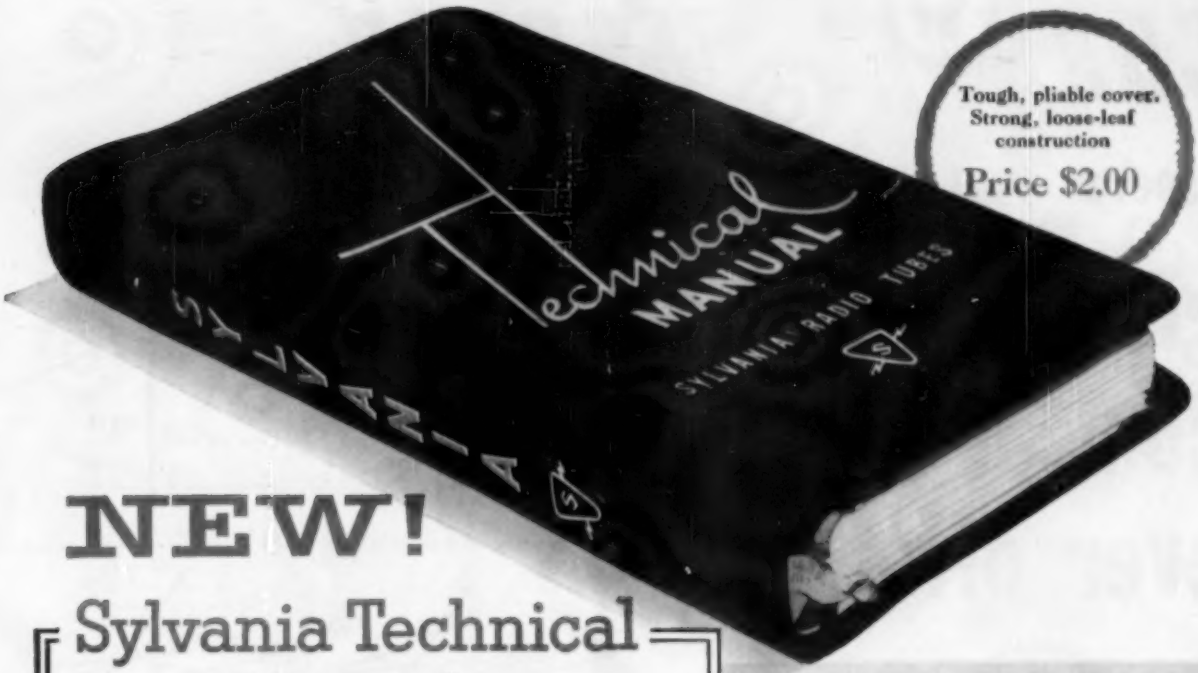
Mr. Cohn, who formerly held the post of executive vice-president, has been an officer of the company since its founding in 1922.

The firm manufactures electronic equipment for communications, radar, and navigational applications and also produces selenium rectifiers, germanium diodes, transistors, and dielectric heating equipment.

* * *

**SANGAMO ELECTRIC COMPANY** of Springfield, Ill., has acquired the assets of **GOTHARD MANUFACTURING COMPANY,** also of Springfield, which will henceforth operate under the name of **SANGAMO GENERATORS, INC.** . . . **TOPP INDUSTRIES, INC.** has purchased the assets and acquired the services of key technical personnel for the full line of potentiometers of **STANDARD ELECTRONIC MANUFACTURING COMPANY** of Culver City, California . . . A community operations division has been formed by **JERROLD ELECTRONICS CORP.** of Philadelphia to handle all phases of community television installations and equipment . . . **AIRCRAFT RADIO CORPORATION** has purchased **ORION INDUSTRIES, INC.** of Richmond, Va., in a move to broaden its airborne communication and navigation equipment line . . . **BECKMAN INSTRUMENTS, INC.** of Fullerton, California, has acquired **SPECIALIZED INSTRUMENTS CORP.** and **SPINCO SERVICE CO.,** both of Belmont, California . . . **BERLANT ASSOCIATES** has been integrated into the group of companies controlled by **AMERICAN ELECTRONICS, INC.** This was accomplished by the merger of **BERLANT** and **ELECTRO-FLOW CORPORATION,** one of the **AMERICAN ELECTRONICS** subsidiaries. The two new subsidiaries will operate under the name of **BERLANT INSTRUMENTS** . . . **BARRY CORPORATION** of Watertown, Mass., has changed its name to **BARRY CONTROLS, INCORPORATED** as being more descriptive of its output . . . **ASSOCIATED MISSILE PRODUCTS CORPORATION** has been organized in Pomona, California. Its 51,000 square foot plant is located at 2709 North Garey Ave. . . . Edward Robinson, former sales manager for **ESPEY,** has organized a sales representative firm, **ROBINSON ASSOCIATES,** with headquarters at 1058 2nd

(*Continued on page 72*)




Tough, pliable cover. Strong, loose-leaf construction

Price $2.00

# NEW!

## Sylvania Technical Manual

### —the most complete, up-to-date, tube reference available

- **Streamline, loose-leaf format makes it easy to use.**
- **Supplement service keeps you up-to-date month by month.**

The new 10th edition of Sylvania's Technical Manual has been brought up to date completely to include the latest receiving tubes, picture tubes, and special-purpose tubes. More pages, more tubes, more features; yet because of its versatile format it's still the handiest, comprehensive manual to use.

Manual owners receive newly released tube data in loose-leaf form regularly so it can be inserted in the manual.

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**Lists over 1000 tube types including:**

- series-string television types
- color television receiving types
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**plus:**

- complete characteristic curves on all important types
- tube tester settings for 184 most popular tubes
- new Crystal Diode Chart
- new special-purpose tube chart
- new Resistance-Coupled Amplifier Data.



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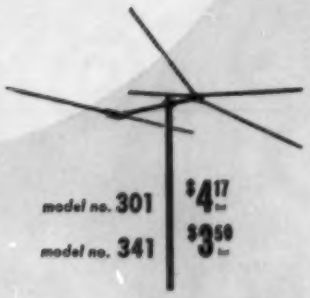
LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY

# CHANNEL MASTER

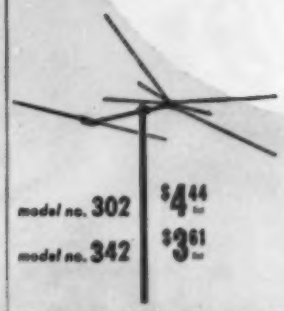
## steers you to the greatest conical values ever offered!

the New

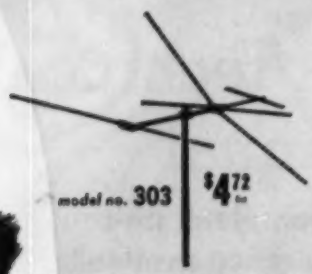
## "MAVERICK"



model no. 301 $4.17
model no. 341 $3.50



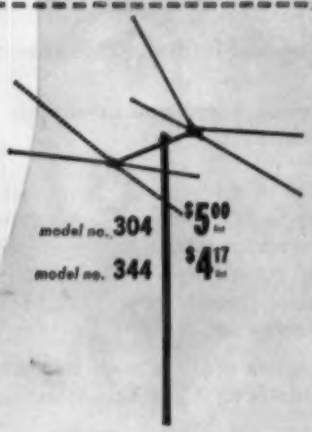
model no. 302 $4.44
model no. 342 $3.61



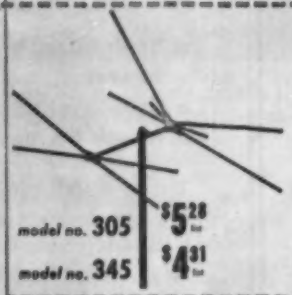
model no. 303 $4.72



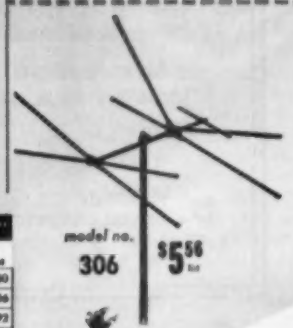
model no. 343 $3.89



model no. 304 $5.00
model no. 344 $4.17



model no. 305 $5.28
model no. 345 $4.31



model no. 306 $5.56

Low-priced conicals? Here is the LOWEST-PRICED, fullest conical line you've ever seen—a complete series of 22 *different models*. Checked out and approved by the Channel Master laboratory, every "MAVERICK" antenna provides outstanding Broad Band reception wherever conical antennas find application. Available both "Super-sembled" and non-assembled, the "MAVERICKS" are, without doubt, today's most sensational antenna buy.

**"MAVERICK 300"**

| model no. | desc. | pack'd | list |
|---|---|---|---|
| 301 | 1-Bay | 6 | $4.17 |
| 301-2 | 2-Bay | 3 | 8.75 |
| 301-8 | 2-Bay | 1 | 9.31 |
| 302 | 1-Bay | 6 | 4.44 |
| 302-2 | 2-Bay | 3 | 9.31 |
| 302-8 | 2-Bay | 1 | 9.86 |
| 303 | 1-Bay | 6 | 4.72 |
| 303-2 | 2-Bay | 3 | 9.86 |
| 303-8 | 2-Bay | 1 | 10.42 |
| 304 | 1-Bay | 6 | 5.00 |
| 304-2 | 2-Bay | 3 | 10.42 |
| 304-8 | 2-Bay | 1 | 10.97 |
| 305 | 1-Bay | 6 | 5.28 |
| 305-2 | 2-Bay | 3 | 10.97 |
| 305-8 | 2-Bay | 1 | 11.53 |
| 306 | 1-Bay | 6 | 5.56 |
| 306-2 | 2-Bay | 3 | 11.53 |
| 306-8 | 2-Bay | 1 | 12.00 |
| 301-3 | Conn. Rods | | .36 |

**"MAVERICK 340"**

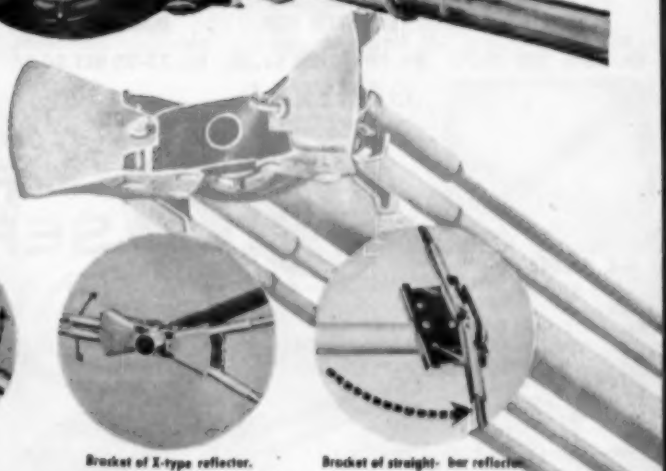
| model no. | desc. | pack'd | list |
|---|---|---|---|
| 341 | 1-Bay | 6 | $3.50 |
| 341-2 | 2-Bay | 3 | 7.36 |
| 341-8 | 2-Bay | 1 | 7.92 |
| 342 | 1-Bay | 6 | 3.61 |
| 342-2 | 2-Bay | 3 | 7.64 |
| 342-8 | 2-Bay | 1 | 8.19 |
| 343 | 1-Bay | 6 | 3.89 |
| 343-2 | 2-Bay | 3 | 8.19 |
| 343-8 | 2-Bay | 1 | 8.75 |
| 344 | 1-Bay | 6 | 4.17 |
| 344-2 | 2-Bay | 3 | 8.75 |
| 344-8 | 2-Bay | 1 | 9.31 |
| 345 | 1-Bay | 6 | 4.31 |
| 345-2 | 2-Bay | 3 | 9.03 |
| 345-8 | 2-Bay | 1 | 9.58 |
| 341-3 | Conn. Rods | | .36 |

**Never before such a complete line of conicals at such fabulous LOW PRICES!**






*The **first** and **only** full line of conical antennas completely*
*"Super-sembled"*



*No hardware, no tools, no tightening— pops open, ready for the mast!*


Director bracket.


Bracket of X-type reflector.


Bracket of straight- bar reflector




Features
**"NOTCH-LOCK"**
**Clamp Plate**
**Elements can't turn or twist loose!**

**This exclusive feature, until now, has been available only in much higher-priced models.**

***NON-ASSEMBLED****

*This **quality** line carries the <u>lowest price-tags</u> ever seen on conical antennas!*

- **Installs in a matter of minutes.**
- **Most popular conical arrangements.**
- **Finest materials; durable, rugged construction.**

***Extra Preassembly Feature!**
On all models with straight-bar reflectors, the reflector element is completely *preassembled* for snap-open installation.

**CHANNEL MASTER CORP.**
ELLENVILLE, N. Y.

WORLD'S LARGEST MANUFACTURER OF TELEVISION ANTENNAS

Write for complete technical literature

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**G-C RADIO-TV SERVICE CEMENT**
Famed high grade adhesive.
**No. 30-2 NET $0.39**



**G-C CEMENT SAMPLER KIT**
Includes 7 different cements.
**No. 345 NET $4.95**



**G-C SILICONE COMPOUND**
Permanent waterproof material.
**No. 8100 NET $0.99**



**G-C ELECTRONIC CONTACT CLEANER**
All-purpose contact cleaner.
**No. 210-2 NET $0.33**



**G-C LONG-REACH LUBRICATOR**
For hard-to-reach places.
**No. 8690 NET $0.48**



**G-C RUF-KOAT WRINKLE VARNISH**
Black, Gray, Brown (specify).
**No. 60-2 NET $0.39**



**G-C DIAL LITE COLOR KIT**
Kit of 5 colors and solvent.
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**G-C GENERAL SKRATCH STIK**
Removes wood scratches.
**No. 909 NET $0.30**



**G-C TV-RADIO DIAL CABLES**
Best nylon cord in 25-ft. lengths.
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**G-C DIAL POINTER KIT**
Box of 25 assorted pointers.
**No. 6805 NET $3.30**



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Assorted wire lengths.
**No. 1738-E NET $0.27**



**G-C ASSORTED SPAGHETTI KIT**
Kit of 26 lengths of spaghetti.
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**G-C NEEDLE-POINT PRODS**
Brass chucks, 6" test prods.
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GENERAL

G-C

CEMENT

*Ask For These*

# RADIO-TV SERVICE AIDS

*...at Your Jobber*



**G-C SPRAY DE-OX-ID**
Cleaner for radio, TV controls.
**No. 19-6 NET $2.97**



**G-C UNIVERSAL TYPE TEST LEADS**
Heavy duty 6000 V. leads 50" long, 6" handles, solderless tips.
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Kit contains 20 fibreloid shims.
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**G-C HARDWARE ASSORTMENT**
Approx. 1,000 screws, nuts, etc.
**No. 6064 NET $1.08**



**G-C TELEVISION SAF-T-RACK**
Sturdy, safe chassis repair.
**No. 8045 NET $3.27**



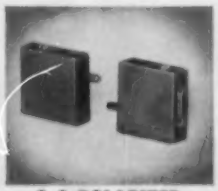
**G-C SPEEDEX WIRE STRIPPER**
Automatic, delayed action return.
**No. 766 NET $4.95**



**G-C YOKE COIL EXTENSION**
Service picture tube in set.
**No. 8847 NET $2.70**



**G-C TYPE II PIN CUSHION**
Reduces fuzzy pin cushion effect.
**No. 8954 NET $0.60**



**G-C POLARIZED TV LINE PLUGS**
For all UHF and VHF lines.
**No. 8596 NET $0.36**



**G-C TV KNOB SPRING-WEDGE KIT**
100 assorted TV knob springs.
**No. 8858 NET $2.10**



**G-C ADJUST-A-LOOP ANTENNA**
Eliminates bulky loop antennas.
**No. 8866 NET $0.60**



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Handy lugs for 300-ohm TV lines.
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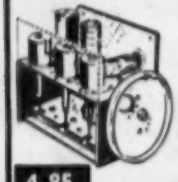
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SK-37, with chrome plated metal grill (Fig. B).
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A specially designed 5" Tweeter and Crossover Network that will assure high frequency response when used with any speaker you now possess. You can now make your present speaker into a 2-way speaker system increasing the high frequency range up to 15,000 cycles. Diagram included. Shpg. Wt. 5 lbs.

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- ★ Variable gain ext. mod. ampl.; only 0.8 v for 30% mod.
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# CAMPUS CARRIER-CURRENT SYSTEM

By PHILIP J. KISER
Purdue University

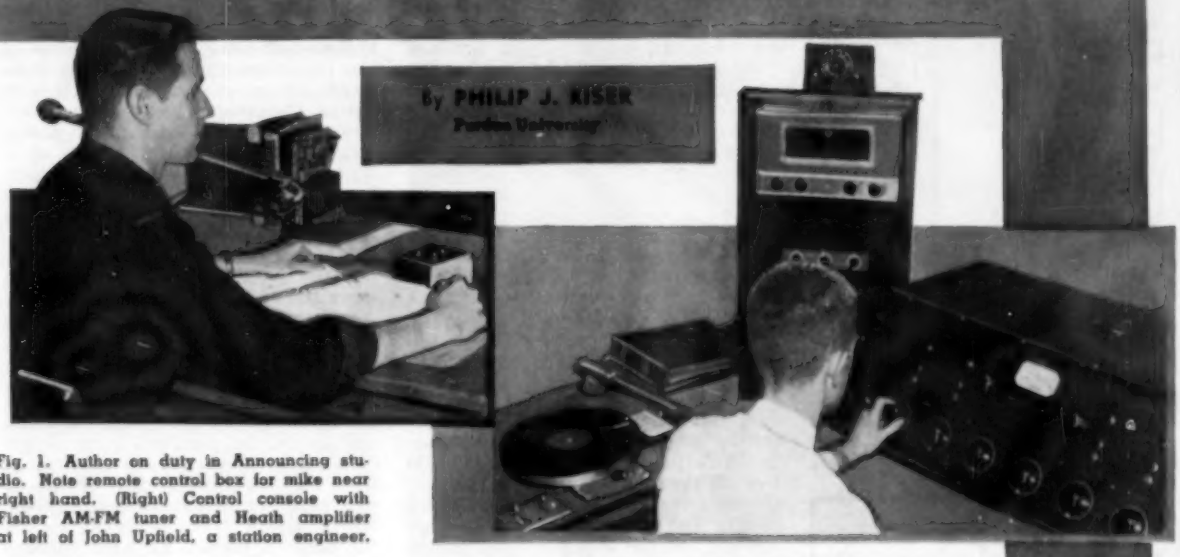


Fig. 1. Author on duty in Announcing studio. Note remote control box for mike near right hand. (Right) Control console with Fisher AM-FM tuner and Heath amplifier at left of John Upfield, a station engineer.

*About 150 colleges and universities are "broadcasting" via carrier-current. Here are details on Purdue's setup.*

A UNIQUE type of broadcasting which has come more and more into use since the war, is now being utilized by about 150 colleges and universities throughout the country. It is nick-named "wired wireless", but more accurately it is called "carrier-current" radio.

Few people realize the extent of carrier current operations by the students in the various colleges. Many of these stations sell time, both nationally and locally, and operate exactly like commercial stations. Others, like the one operated by the members of Cary Club (men's residence halls) at Purdue University, are sustained by the listeners directly.

The author knows of two advertising agencies which cater exclusively to such college stations. There is also a national organization, IBS (Intercollegiate Broadcast System) which such stations may join. IBS offers legal, technical, and program aid to member stations.

The installation at Purdue University is typical of the big-time operation that carrier-current really is. The station occupies the sixth floor tower of one of the men's residence units. Its audience is almost entirely students and during peak hours numbers a potential 3000. Often about 90% of the radios in operation are tuned to the student station, WCCR.

The station goes "on the air" at 6:30 a.m. and remains on continuously until 1:00 a.m. the next morning (2:00 a.m. on Fridays, Saturdays, and Sundays) giving the listeners 18½ hours of continuous, non-commercial music. This compares favorably with most local commercial stations. Programs range from jazz and "Dixie" all the way to classics. An unpaid staff of over 100 men and women run the station its 130 hours a week. We train and maintain a staff of about 30 announcers each year, as no one person can spend too much time with this extra-curricular activity.

Besides the regular staffs for programming, announcing, engineering, news, etc., the station maintains a research and engineering staff. It was this staff that solved the problem of covering particular sections of the city (not on campus power lines) with our carrier signal.

*EDITOR'S NOTE: As we go to press we have received word from Purdue that they now have four off-campus satellites in operation and a fifth is in the process of being installed. The new stations have added about 450 listeners and when the fifth is completed an additional 500 persons will be able to pick up the programs. According to one unofficial source, station WCCR has the largest listening audience of any college carrier-current station in the country. In addition, the school is said to be the only one that has succeeded in tieing in some of the off campus buildings.*

As in the case of Purdue, the administrations of most colleges are very happy to sanction this type of broadcasting because it fulfills a need —experience and training in radio broadcasting—for the interested students, that could not otherwise be satisfied. These all-student stations also provide a quick and sure way of reaching the student body in cases of emergency.

A carrier-current installation can be quite elaborate, composed of expensive commercial equipment, or can be very serviceable using strictly home-made gear. WCCR has come up with a combination of the two and is as well equipped as any small commercial station—and many larger ones.

The heart of any radio station is the control console. See Fig 1. Any of the small commercial models (called "consolettes") can be used. We chose to have one custom built for us by the local "Campus Electronics Service." Our board has relay push-button controls on the channel inputs. This was done to make it possible to control the channels remotely. Thus our announcers control their own mikes. When the channels are off, the relays automatically switch the turntable inputs to "cue" (audition). Our board (see Fig. 4) has four input channels: one for each of two turntables, one for the mike inputs, and one essentially for remotes and extra use. A patching arrangement determines which mike will feed the mike input channel. Each mike has its own preamp mounted in a rack in the control room.

The second items of necessity are the turntables. We chose *Rek-O-Kut* Model LP-743 mechanisms and tables, mounted in our own bases. These are three-speed mechanisms accommodating everything from 45's to 16" transcriptions. We use *Clarkstan* Model 212, 16" arms and the commercial type *G-E* triple-play pickups (Model RPX 047).

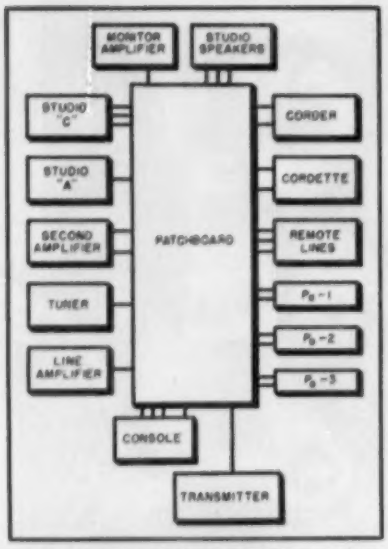



**Fig. 2. Patchboard used at Purdue provides increased flexibility of the entire system.**

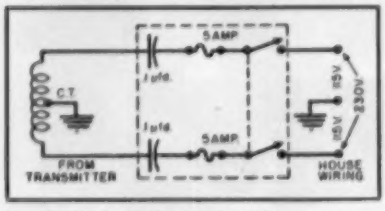



**Fig. 3. Method of tying into the power system. Note tie must be made to both sides of 230-volt line for full service coverage.**

Because of the many different types of records on the market today, there is often some confusion as to what type of equalization to use. We solved our equalization and turntable preamp problems by buying *Fisher* preamps (Model 50-PR). These self-powered units have four low-frequency turnover points and four roll-off points.

Our second year on the air we bought a *Magnecord* tape recorder adding another our third year. One unit is rack mounted and the other remains in its portable case, sitting on the rack ready for remotes. It can be used just as though it, too, were rack mounted. See Fig. 6.

We have greatly increased the flexibility of our system with a well-planned patchboard. See Fig. 2. To make the most of our board we use single jacks and plugs. All of the console inputs, preamps (ins and outs), tape recorders (ins and outs), tuner, program and monitor amps (ins and outs), and the transmitter line appear, normalled through, on the board. In addition are a line to WBAA, the local state-owned educational station on campus; a line to the other carrier-current station on campus; the remote lines; and lines to our satellite transmitters in the other living units. This flexible patchboard means, for example, if a preamp goes out another can readily be patched in to take its place. The same holds true for all the other amplifiers, including the main program amplifier. This means the station would never have to be off the air more than a few seconds due to technical failure.

WCCR has taken advantage of its lofty location by installing its FM receiving antenna on the roof, one floor up. This puts the antenna about 100 feet off the ground. The station purchased a *Fisher* AM-FM tuner (Model 50-R). The combination of the high antenna and the sensitive tuner brings in FM stations from as far away as 250 miles. The antenna has six elements—two active and four reflective. We have picked out a good strong FM station with continuous music and rebroadcast some of their programs directly over our station. The station, WEFM owned by *Zenith Radio Corporation*, 120 miles away in Chicago, broadcasts non-commercial music on 99.5 mc. We carry, with permission, five hours of their programs during the time of day when we would normally be short on personnel. The tuner feeds an amplifier which, in turn, feeds our local transmitter and the line amp to our remote transmitters, bypassing the console and other equipment. This means the station can be left unattended during part of the day with only three pieces of audio equipment running—the tuner, its amplifier, and the line amplifier. See Fig. 1.

The thing which makes carrier-current radio unique is, of course, the way the r.f. signal is carried from the transmitter to the individual receivers. By far the most popular means is the use of power lines—mostly because they are already installed and thus form a free route to each radio on the system. This all sounds simple and most convenient at first glance, but only at first glance.

Since the installation at Purdue is typical and since it involves most of the conditions that might be encountered in a carrier-current system (large buildings grouped together, large buildings a block or so apart, large buildings several blocks or a mile apart, and remotely located buildings on some other power system quite a distance from the studios) it will be described in detail.

The first carrier-current transmitter installed at Purdue was designed to serve Cary Hall, a group of five buildings forming the men's residence halls on campus. These buildings are arranged in a rectangle two blocks long by one block wide and house 1600 men. As mentioned before, the studios are on the sixth floor of one of the buildings and the original plan was to install the transmitter in the studios and tie in with the power lines right there. It was here we learned lesson number one—a power transformer is one of the best r.f. chokes we have encountered. We discovered that each of the five buildings has its own step-down transformer from the university's 2300-volt lines and hence each building is almost completely isolated from the others as far as our r.f. signal is concerned. We solved this problem by running a separate r.f. line from the transmitter to each building and made the tie-in with each local power board.

A point worthy of note here—when tying into a power system, it is necessary to be sure a tie is made to *both* sides of the incoming 230-volt line, otherwise only half of the building will be covered. See Fig. 3.

It is best to use at least a parallel pair when running the r.f. any distance. Better yet is twisted pair, shielded pair, or coax, in that order, the latter being rather expensive for any distance. We have found it quite satisfactory, from a radiation standpoint, to use a parallel pair of wires. Telephone drop line, for example, makes an excellent r.f. line.

The transmitter used in the original installation, Fig. 5 (Cary Hall), was designed and built by the "Campus Electronics Service," mentioned previously. The unit has an adjustable power input of about 10 watts maximum. Using full power we still remain well within the legal limits of radiation as set forth in Section 15 of the FCC rules governing limited radiation devices. In simple language it means that at a frequency of 600 kc. (our operating frequency), you may radiate enough power to be picked up on a good car radio not more than 263 feet from any power line carrying the signal. As the frequency goes up, of course, the allowable radiation limit decreases. This, then, is why most carrier-current operations are found below about 700 kc.

Less than a year after WCCR began

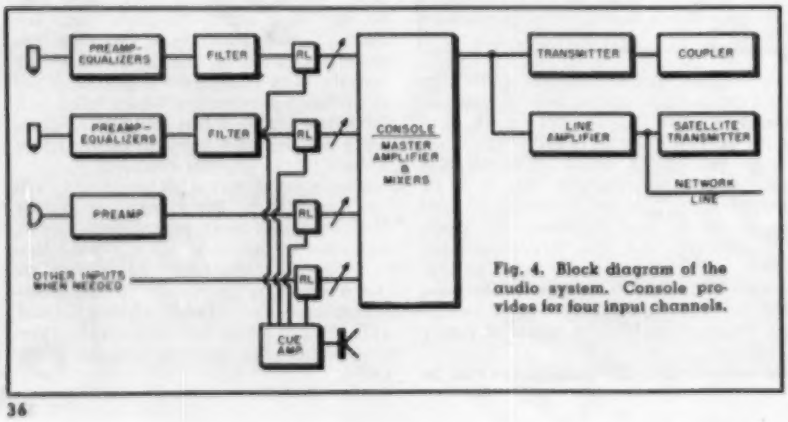



**Fig. 4. Block diagram of the audio system. Console provides for four input channels.**

operation in the men's residence halls, it was decided to extend the service to the women's halls, which, because of the transformers in the university's power lines, were not getting enough r.f. signal to be detected. One solution would have been to run r.f. lines the mile distance through the university's service tunnels. The cost, however, would have been prohibitive, besides not being sure of having enough r.f. signal left to put an adequate signal into the buildings.

It turned out to be much more economical to have another transmitter built and installed. This unit has about 5 watts' input and seems adequate for the women's buildings and the new men's halls about a block and a half away. See Fig. 7. This third group of buildings, housing slightly over 600 men, was brought into the network shortly after the installation of the women's transmitter, but this time the university's service tunnels were utilized. A parallel pair carrying the r.f. was run the one-and-one-half blocks from the women's transmitter to the main power board in the men's building.

The 5-watt satellite transmitter was fed programs over a rented phone line, commonly referred to as a "radio loop." The transmitter was turned on and off by a simplex circuit on the phone line. The residents of these two housing units have since built their own studios and now originate most of their own programs, however, the orignal radio loop is still in operation and when they are not originating programs, WCCR can still control and feed programs to their transmitter.

Incidentally, the cost of this radio loop is $4.75 a month for the half-mile distance. Rental of such loops is charged on a line-of-sight basis. This comes to about $50 a school year which is quite reasonable considering the service rendered. It would take many years of phone rentals to pay for a permanent line through the tunnels.

It follows that since the signal from the parent station could not be received in the women's halls originally, then no problem involving interference or "beats" would occur. (Both transmitters operate on 600 kc.) This has been verified since the installation.

An entirely different problem of transmission arose when the fraternities and sororities—located from a block up to a mile from the campus—became interested in receiving the non-commercial, all musical programs of WCCR. These houses are on the city, not university, power lines, as well as being on the city, not the campus telephone exchange. Since there was no tunnel system upon which to rely, there was some question as to how we could put an r.f. signal, modulated with audio from our studios, into a potential 66 houses (housing some three-thousand students) spotted here and there over a couple of square miles. The telephone company was unable to provide individual radio loops to each house even if the groups desiring the service were willing to pay for it. As in the case of many proposed carrier-current installations, the problem at first looked nearly impossible. But an easy survey and the experience of our previous installations brought about a long-range plan which seems to be feasible and reasonably economical.

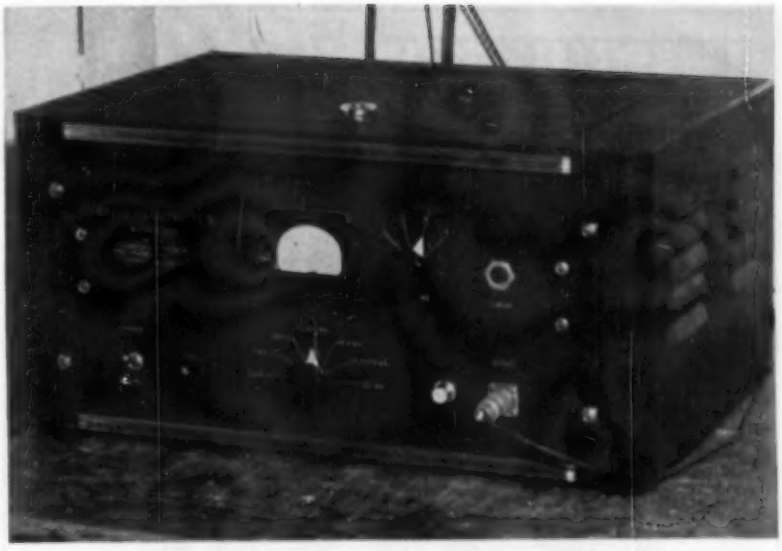


**Fig. 5. Transmitter in operation in Cary Hall. One meter and a multi-position switch gives data on all necessary circuits. Transmitter was home constructed.**

Please note, however, that the following plan is only in the first stages of execution. We may find ourselves with other technical problems before we are able to cover all of the off-campus housing units.

First we broke the 66 housing units under consideration down into groups or zones according to which power transformer they were on. For identification purposes a zone number was assigned—twenty-six zones were used. The idea was, of course, that if we could get a carrier current transmitter into one house in each zone, then theoretically the other dwellings on that same power transformer (zone) would also get the signal—but that houses on adjoining transformers would not get any signal from the other zones' transmitters since we had already determined that r.f. will not pass through a transformer. In the cases of adjoining zones that have fraternities or sororities next door to each other, an r.f. drop line could be run interconnecting the two zones, thus eliminating the need for another transmitter for the adjoining zone.

Secondly, realizing that there were only five main telephone cables serving the sections of the city in which we were interested, it again became evident that if the audio signal from our studios was put on one pair in each of these cables, then it could be tapped off where needed. This made it physically possible for the telephone company to help us in more cases. Of course, each tap off the audio lines was classified as one radio loop rented line-of-sight from our studios. But now the plan is that 66 houses pay for about 20 radio loops, instead of the original plan of 66 houses paying for 66 separate loops.

We have just begun to put this plan into operation. Our engineers have one

**Fig. 6. Some of the equipment used by the station. From top to bottom, Magnecorder, Magnecordette, and 56-position patchboard. All preamps and the line amplifier are mounted in bottom section which is covered by a plate. Not visible in the photo.**



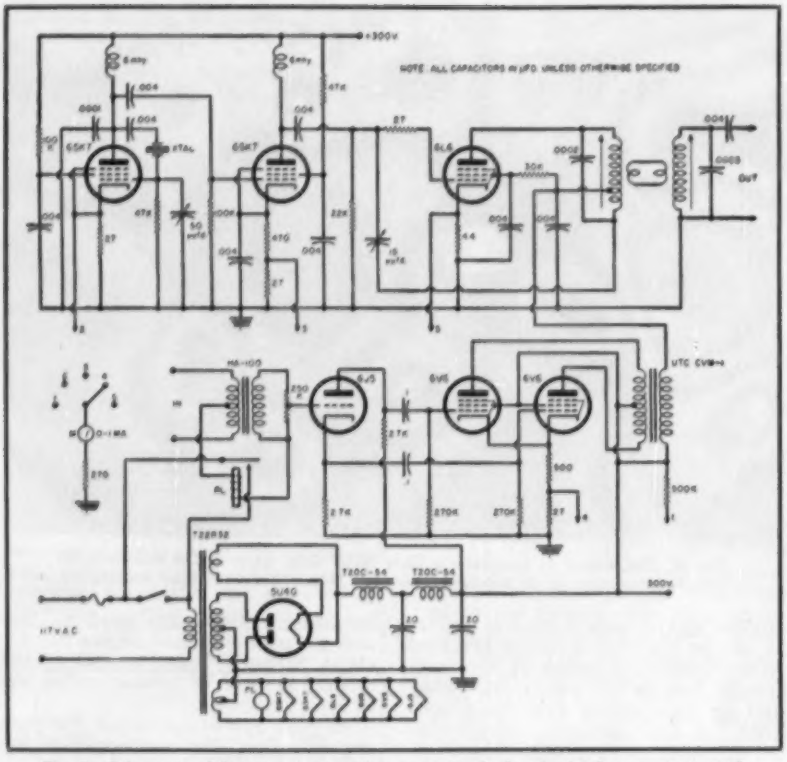


Fig. 7. Schematic of 5-watt unit operating in women's dormitories by remote control.

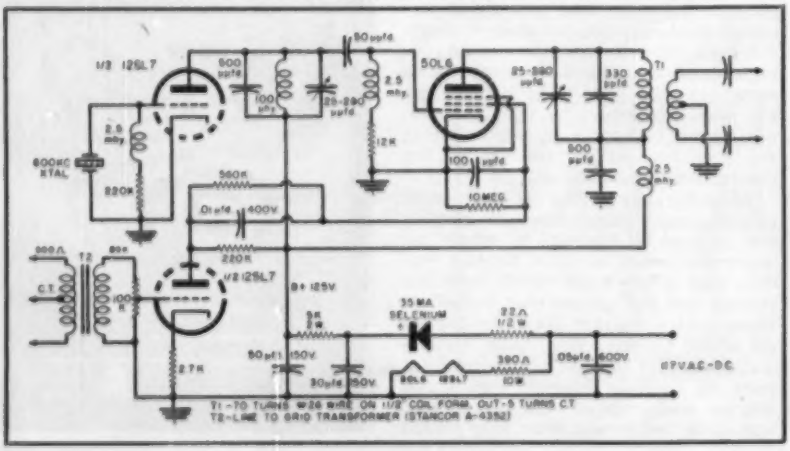
transmitter installed and the groundwork laid for the others. This year may see up to eight more added to the system. Besides the average of three student residences in each zone, remember too that in most cases there will be several private homes receiving the signal.

One of the biggest problems in our case is the availability of phone lines. Each campus will, no doubt, have its own unique problems to solve. It was with the idea of sharing the solutions to some of ours that this article was undertaken.

The construction and performance of our one satellite in the city might be of some interest to other stations with small areas to cover. The transmitter is small and easy to build, employing only 2 tubes. We used crystal control, both for stability and ease of changing frequencies, if necessary. The units were purposely kept small and simple for ease of construction and minimum service. Parts are all standard and can be ordered from any good-sized mail-order house (except for the coil which can be wound on a standard plug-in coil form). The crystal must be ordered specially ground. The total cost, including the crystal, comes to about $24.00. The schematic of this transmitter is shown in Fig. 8.

We use the same means of coupling for all of our r.f. lines. The switch box,

Fig. 8. Schematic of the two-tube, crystal-controlled satellite transmitter.



fuses, and capacitors will add slightly to the cost. Our standard coupling is shown in Fig. 3.

After making this initial installation on the city power lines, we took a very sensitive portable receiver on a tour of the neighborhood. A good signal was detected in every house within the block, and *no* signal in the houses in the adjoining zones. However, by following the "high lines," we could get the station (when directly under the lines) for several blocks. From this we deduced that a little r.f. was getting through the transformer to the high lines, but not enough to get back down to the low lines in the next block or zone.

Incidentally, we used 600 kc., but have crystals on hand for adjacent frequencies should there be any danger of beating in adjoining zones.

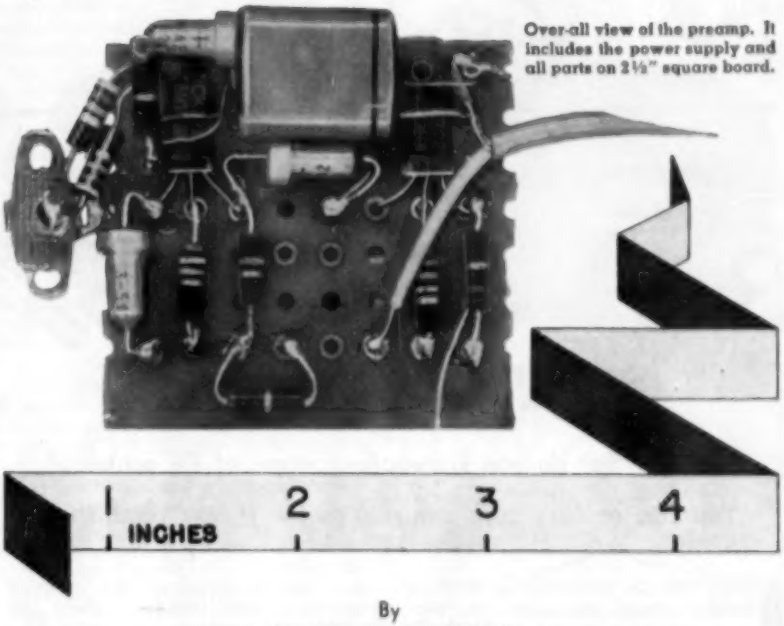
Even without the proposed new rules, now under consideration by the FCC, a new station should choose carefully when selecting its operating frequency. The frequency preferably should be under 700 kc. and not have a strong station within 20 kc. of it. The strongest station on your operating frequency should not put a signal of more than 1/100 of what yours will be into the area you expect to serve. The beat caused from such interference would be even more noticeable if, as proposed, the carrier-current stations are required to switch to odd multiples of 5 kc. frequencies. The beat then would be 5000 cycles—very objectionable!

Watch that second harmonic, too! Be sure it does not interefere with anyone and that it doesn't over-radiate. It may be necessary to put a filter on the output of your transmitter.

One of the advantages of carrier-current radio is in the frequency response obtainable. Commercial stations are held to 5000 cycle response to eliminate interference between adjacent stations. However, if your choice of operating frequencies has been wise, you may broadcast with a frequency response comparable to FM. Our main transmitter has good response up to about 20,000 cycles. Of course, there are not many receivers capable of reproducing this, but some of the hi-fi fans in our audience have built crystal receivers in conjunction with their high-fidelity amplifiers and they really enjoy the quality reproduction. We have several times sponsored hi-fi programs using master tapes—and, of course, our daytime classical music is rebroadcast right off of FM. We also do at least two remote live musical pickups each week.

This is the story of only one carrier-current radio station. Each of the many in the country is busy solving its own problems, training young people in the art of radio broadcasting, and furnishing thousands many pleasant hours of listening. Carrier-current radio is just another of the many devices currently available for communications, but is a medium that is gathering new adherents at a truly remarkable rate. —30—

# A PRACTICAL TRANSISTOR PREAMP




Over-all view of the preamp. It includes the power supply and all parts on 2½" square board.

By
**BERNARD EDELMAN**
Dynamics Test Engineer, Convair

*The development of the CK727 low-noise transistor makes the construction of this compact unit possible.*

RECENTLY many articles have appeared describing practical applications for transistors. Still, work with transistor circuitry has been avoided by the audio experimenter and hobbyist. Skepticism came with the advent of the transistor (*i.e.*, noise, cost, "temporary" battery supplies) and has remained to discourage much-needed exploitation of the new field.

In a short time, transistors have come a long way. To you, the hobbyist, a simple preamplifier can be constructed in a matter of hours, for a cost equal to that of the commercially available single-tube magnetic pickup preamplifiers. The complete unit may be mounted on a board 2½ inches square, power supply and all. Internal noise is essentially inaudible at more than comfortable music-listening levels. A practical 6-volt battery supply (consisting of *Mallory* mercury cells) will provide better than 2000 hours of service. This means that with an average of four hours usage per day, you can forget about the supply for a year and a half! All parts are easily available on the open market, or in the junk-box.

Several working models of the preamp have been built, with no custom tailoring necessary. A straightforward circuit is used, with grounded emitters and no tricky feedback (see Fig. 1). The *Raytheon* CK727 low-noise transistor is used in stage 1, followed by the popular CK722 in a similar circuit arrangement. In resistance coupling of transistors, there must be a compromise made on the values of load resistance. The impedance match must be as close as possible (about 20,000 ohms optimum), yet this impedance must be low enough to allow proper collector current to flow without demanding too high a supply voltage "pump."

Although transformers solve the problem, they are bulky, expensive, and limited in their frequency response. But with grounded emitters, there is still gain to burn. The db wasted due to compromise will never be missed. This preamp still ends up with a gain of 2000 on voltage. The base resistors were set for low noise, low distortion, and best gain for the stage. The values are not highly critical, and 10% parts are used throughout. The coupling capacitors are large in value, since they work into the low impedance base circuits. Five or eight μfd. electrolytics at very low voltage ratings are small and fairly inexpensive. The author's model uses tantalums, but this is not necessary. Notice that the output impedance is very low, and long leads from the preamp cause no losses. The output capacitor may be smaller, since it is assumed that the unit will work into a high impedance input of the main amplifier.

The simplest solution to the equalization problem was to equalize right at the pickup. A *G-E* was used for tests, aiming at the NARTB curve. The low impedance input of the CK727 was a help rather than a hindrance, since the equalization components are also of low impedance, and there was no stray pickup or hum problems. The series resistor to the pickup both completed the equalizer design, and presented the proper load to the pickup. The equalization circuit may be glorified into a selector switch choice of a number of the curves, with no evils of high impedance. The attenuation and insertion loss of this equalizer are of no consequence to the preamp following, with its gain of 2000. The resultant output from LP's is close to one volt delivered across the 6800 ohm load resistor.

Total battery drain from 6 volts is .9 milliampere. The batteries (4 series cells) were mounted right on the reverse side of the small fiber board used as a chassis.

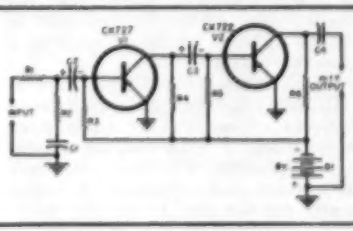
There are features to this little job not to be overlooked. By definition, the hum is zero, not an earthshaking attribute, but a most satisfactory condition. The hum pickup and microphonic susceptibility of the preamp are so low that the unit may be mounted directly below the arm on a changer. The power "on-off" switch can be rigged to a muting switch if one exists, since there is no warmup time. Otherwise, a 117-volt relay may be put across the phono motor.

The over-all result will be an equalized one volt of signal from your turntable, humless and virtually distortionless. The changer (or turntable) may be taken for granted as it always has been, but now you may put your am-

(*Continued on page* 86)

**Complete schematic diagram and parts list for the compact transistor preamp.**

$R_1$—22,000 ohm, ½ w. res.
$R_2$—1500 ohm, ½ w. res.
$R_3$—390,000 ohm, ½ w. res.
$R_4$—10,000 ohm, ½ w. res.
$R_5$—330,000 ohm, ½ w. res.
$R_6$—6800 ohm, ½ w. res.
$C_1$—.2 μfd., 100 v. capacitor
$C_2$, $C_3$—5-8 μfd., 6 v. elec. capacitor
$C_4$—.02 μfd., 100 v. capacitor
$B_1$—6 volt battery (four 1½ volt cells in series)
$V_1$—CK727 transistor (Raytheon)
$V_2$—CK722 transistor (Raytheon)



# CONTROLS FOR YOUR TV RECEIVER



Typical concentric volume control and "on-off" switch used in TV receiver and the various component parts from which it is assembled.

By

**ESMOND E. JOHNSON**

International Resistance Company

*Part 1. What do you know about taper of TV controls? You can replace such controls faster if you read this.*

ADJUSTING a TV set to produce a bright, sharp, distortion-free picture can be a service technician's lark or his time-consuming headache. It's largely a question of how much the service technician knows about the controls in a TV set—what they are for, how the control circuit works and, especially important, how to replace control rheostats or potentiometers when necessary with exactly the right one for the job.

In the days of radio sets alone, there was little or no adjustment problem. Radio sets, old or modern, have only a volume control, usually a tone control, and sometimes a sensitivity or a hum control, and these are adjusted mainly by ear. The process of receiving a picture, however, is far more complex, and the controls of the TV set for all the functions involved—synchronization, focus, contrast, centering, and picture size—must be adjusted to function as a team if the received picture is to be the clear, undistorted image the customer wants to see.

Not only are there many more controls in a TV set than in a radio, but, in the TV set there are many more concentric dual controls, which makes the control replacement more difficult.

Each of the five major sections of a TV set has several controls which play an important part in getting the picture in adjustment on the screen. An over-all idea of all the controls used in a standard TV set can be obtained at a glance from Table 2.

Manufacturers make each control exactly right for the job in each control circuit. Good TV set adjustment therefore begins with making a control replacement, whenever required, with just the right rheostat or potentiometer for the job. To do this properly a service technician has to know these basic electrical facts about the control: its resistance, its power rating, and its taper. Power rating is easy to judge by resistor size and is marked on the case. The control's resistance value is also marked. But to replace a control with another of exactly the right taper, the service technician should know the following about taper in controls.

## Taper—What and Why

What is taper and why is correct taper so important in each control circuit? Furthermore, if you don't know the correct taper for a control, how do you find it?

The principal characteristic desired in a control is that it should permit smooth adjustment. That is, each 5 or 10 degrees of rotation of the shaft should provide an equal adjustment step in the circuit. The bane of the service technician's existence is those controls in which a slight rotation at the start produces a big adjustment, and rotating the shaft the rest of the way produces very little adjustment. The desired evenly-spaced adjustment is obtained in most cases by giving the control rheostat or potentiometer the right taper.

Suppose you start rotating a control rheostat from the zero resistance, counterclockwise (CCW) end and measure the resistance between this end and the contact arm (CT terminal) for every 10 degrees of shaft rotation, as illustrated in Fig. 1. If you make a graph of the resistance against shaft rotation, this curve (Fig. 2) will show how the resistance tapped off by the contact arm changes with increasing shaft rotation. The shape of this graph is called the control's "taper."

If the control is a wirewound rheostat or potentiometer with the resistance wire the same size throughout and the turns equally spaced, the resistance increases the same amount for each degree of shaft rotation, and the graph for this is a straight line ("A" in Fig. 2). This is called a straight line or linear taper. However, in many control circuits, control adjustment is desired in decibel steps. This requires a rheostat or potentiometer in which the resistance from one end to the contact arm increases slowly at first, then shoots up fast along a logarithmic curve ("B" in Fig. 2), giving the control a logarithmic taper, also commonly called a left-hand (L.H.) log or audio taper. Sometimes a reverse action is desired—a sudden resistance drop, then a gradual decrease ("C" in Fig. 2). This is known as a right-hand (R.H.) or reversed log taper, and provides the same resistance variation as the audio taper when the control shaft of the latter is rotated in the reverse (counterclockwise) direction.

For the most part, all television controls, either composition or wirewound, have one of the three resistance tapers shown in Fig. 2. A practical example will show how a logarithmic taper produces uniform adjustment in decibel steps.

Take, for example, the volume control with the left-hand log taper shown by curve "B" in Fig. 2. The attenuation, in decibels, which such a control produces as the shaft is rotated can be easily computed using the resistance values which are presented in column two of Table 1. The attenuation is calculated from the voltage ratio, that is, the ratio of the voltage across the control's total resistance to the voltage across the part of its resistance tapped off by the contact arm. Since voltage ratio is the same numerically as resistance ratio, the latter can be used to calculate the db attenuation.

The attenuation in decibels for each

control shaft position for the L. H. log pot of columns 1 and 2 in Table 1, is equal to $20 \times \log_{10}$ of resistance ratio. For example, at 50% rotation, the tapped-off resistance is 10% of the control's total resistance (see Table 1), so the resistance ratio is 10. Since $\log_{10}$ of $10 = 1$:

*Attenuation (in db)* $= 20 \times 1 = 20$ *db*

Computing the db attenuation in the same way for all the resistance values in the center column of Table 1 gives the attenuation values in the last column. If these calculated attenuation values are plotted against per-cent rotation, the curve is very nearly a straight line and shows that the control with this log taper produces nearly equal, uniform (smooth) decibel steps of attenuation as the shaft is rotated.

Another important reason for producing controls with special tapers is that a special taper can cut down the heat dissipation in a control, and permit the use of smaller controls of lower power rating. Some form of R.H. log taper giving 10 to 20 per-cent of the total resistance at 50 per-cent rotation is the type of control most often used for this purpose.

Knowing what the taper of a control rheostat or potentiometer is and why it is important, the next natural question is, "How do you find the taper of such a control when you want to replace it?"

The best way is to refer to the manufacturer's catalogue, which usually says what the taper is for each control. But, if the catalogue is not available, the control's taper can be determined by first checking to see that the control is electrically intact, *i.e.*, has no open circuit, short, or loose contact. Then, hook up an ohmmeter to measure its resistance at different points of shaft rotation. Measure the total resistance of the control with an ohmmeter connected between the counterclockwise (CCW) terminal and center terminal (CT) with the control shaft turned to its maximum clockwise position. Now, turn the control shaft back to 50 per-cent of its rotation and note the reading of the ohmmeter. If the resistance is about 50 per-cent of the total reading, the taper is linear. If the resistance is about 10 per-cent of the total, the taper is audio. A resistance of 90 per-cent of total indicates a R.H. log taper. For better accuracy, a R.H. log taper is usually measured between CT and CW terminals. In this case, the measured resistance at 50 percent rotation would be about 10 per-cent of the total.

Once he knows how to get the right control rheostat or potentiometer to replace the one in the control circuit, the other information on TV controls which the service technician needs to know to do a good, quick job of set adjustment and control replacement can best be grasped by studying, one at a time, the control circuits in each major section of the TV set—the audio, video, horizontal sweep, vertical sweep, and low-voltage power supply.

A TV set may have the following controls in its audio section: volume, tone, AM rejection (buzz), and ratio detector balance. This does not mean that any one television receiver has all of these controls. Some may have only a volume control, others, a volume and tone control, etc. The volume control generally adjusts the sound output from the speaker by regulating the amount of signal fed from the ratio detector or discriminator to the grid of the first audio stage. This control is tapped at 50 per-cent of its total resistance to accommodate a low-frequency boosting network. This is for the purpose of increasing the low-frequency response at low volume levels, to make up for the insensitivity of the ear at low frequencies when the volume is turned down. Two taps with two resistance-capacitance networks are sometimes used in deluxe models to increase the effectiveness of the bass boost over a wide range of volume level.

Since negligible power is dissipated in this control, the only requirement for a replacement is that it meet electrical and mechanical specifications and does not become noisy in service. In many TV sets the volume control is the rear section of a concentric dual control, the other section of which is the tone control.

The tone control either reduces the high-frequency response or the low-frequency response when turned either direction from the position for normal operation. This control dissipates negligible power, so any good ¼ to ½ watt potentiometer meeting electrical and mechanical specifications makes a satisfactory replacement. A linear taper control could be employed here, but one with a special double audio taper from center of rotation will perform much more smoothly.

Sometimes, the tone control is of the switch type rather than the continuously variable type. One position of the switch may short out a capacitor in a bass boost network, reducing the low-frequency response. In another switch position, a capacitor from the 1st audio tube plate is connected to ground, shorting out the high frequencies.

Some additional controls in the audio section, as well as the controls in the other sections of the typical TV receiver, will be discussed next month.

*(To be continued)*

**Table 1. Attenuation in decibels for the various shaft positions of a control potentiometer with a left-hand log taper similar to curve "B" in Fig. 2.**

| PER-CENT ROTATION | PER-CENT RESISTANCE* | CALCULATED ATTENUATION |
|---|---|---|
| 0 | 0 | ∞ db |
| 10 | 1 | 40 db |
| 20 | 1.5 | 36 db |
| 30 | 2.0 | 34 db |
| 40 | 3.5 | 25 db |
| 50 | 10 | 20 db |
| 60 | 25 | 12.8 db |
| 70 | 45 | 7.0 db |
| 80 | 66 | 3.7 db |
| 90 | 87 | 1.2 db |
| 100 | 100 | 0 db |

*In this particular case, the per-cent resistance is the same as the actual resistance.

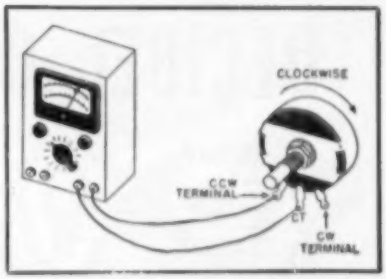



**Fig. 1. Hookup for measuring the resistance change in a potentiometer with increasing rotation of the shaft. This is done to find the taper of the potentiometer.**

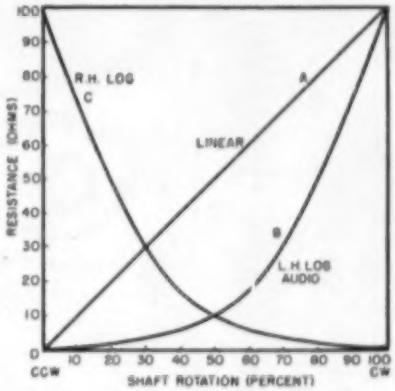



**Fig. 2. Graph of resistance variation with increasing shaft rotation of a particular control potentiometer or rheostat.**

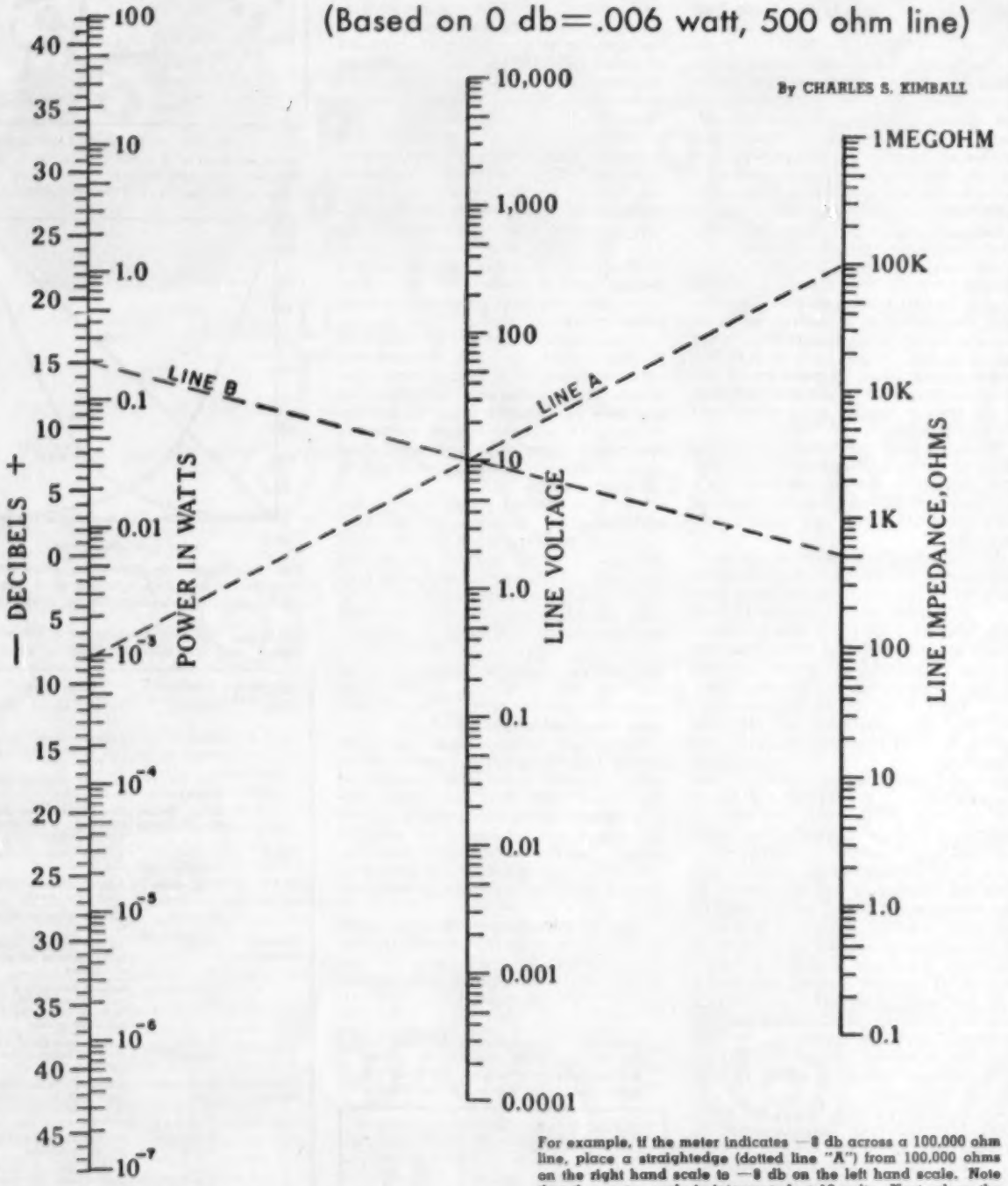
**Table 2. The five sections of a TV receiver and the controls used in each.**

| SECTION | CONTROLS | FUNCTION |
|---|---|---|
| Audio | Volume | Adjust sound output |
| | Tone | Adjust high and low audio frequency response |
| | AM Rejection (Buzz) | Reduce intercarrier buzz |
| | Ratio Detector Balance | Compensate for unbalance in components (tubes, etc.) |
| Video | Automatic Gain Control | Adjust gain to signal level |
| | Brightness | Adjust picture illumination level |
| | Contrast | Adjust picture tone values |
| Vertical Sweep | Height | Adjust picture size to fit vertical height of screen |
| | Vertical Hold | Adjust frequency of vertical oscillator to lock in with vertical sync pulse |
| | Vertical Linearity | Adjust height of objects to normal proportions |
| Horizontal Sweep | Horizontal Hold | Adjust horizontal oscillator frequency to lock in with sync pulse |
| | Horizontal Width | Adjust picture to fill width of screen |
| | Focus (Electrostatic control) | Adjust size of electron beam to produce sharp picture |
| Low Voltage Power Supply | Focus (Electromagnetic control) | Adjust electron beam size to produce sharp picture |
| | Horizontal Centering | Adjust picture position to center on screen horizontally |
| | Vertical Centering | Adjust picture position to center on screen vertically |

# DECIBEL CONVERSION NOMOGRAPH

(Based on 0 db = .006 watt, 500 ohm line)

By CHARLES S. KIMBALL




Frequently in decibel measurements the need arises to use the meter across line impedances other than 500 ohms at which the instrument is calibrated to read decibels; hence a correction factor must be applied to the indicated db meter reading for every line impedance other than 500 ohms. This correction factor can be quickly determined from the accompanying nomograph.

For example, if the meter indicates —8 db across a 100,000 ohm line, place a straightedge (dotted line "A") from 100,000 ohms on the right hand scale to —8 db on the left hand scale. Note that the center scale is intercepted at 10 volts. Next, place the straightedge from 500 ohms on the right hand scale (dotted line "B") through 10 volts on the center scale; this line intercepts the db scale at +15 db. This is the correct reading. Note that the difference between the indicated meter reading, —8 db, and the correct value, +15 db, is 23 decibels; this correction factor remains constant whenever the meter is used on a 100,000 ohm line impedance.




**Fig. 1. Shown here is some of the promotional material available from battery manufacturers for your shop windows to make the portable set owner battery conscious and help you sell service.**

# IT'S TIME FOR PORTABLES

By **BILL BOUIE**

*With everyone listening to the baseball games or going on picnics with the portable radio, now is the time to make them aware that your shop is their service center.*

IT'S a pretty safe bet that a portable radio of some sort can be found in practically every home in the country. Millions of these sets have been sold and millions more still roll off the production lines each year. They range in size from the compact little units that can fit into a pocket to the big powerful jobs with round-the-world coverage.

To the enterprising service technician, portable radios can constitute a considerable portion of his servicing income. Because of the conditions under which they are operated, they usually require more attention than either home radios or television sets. Batteries have comparatively short lives in most of them because of the drain due to continuous hours of operation. Also, they are subject to defects and breakdowns due to rough handling and outdoor weather conditions, and, of course, the same "normal" faults that affect any other radio device, only more so. So you see, there's a lot of work to be done on these little sets and there is no reason under the sun why you shouldn't get a lot more of it. We'll have more to say later about how to get the business, but right now let's take a look at some of the more common troubles that bedevil portable radios.

## Batteries

Since every portable radio relies on battery power for operation most (and often all) of the time, a substantial stock of the most-used battery types should be on hand during the portable season. In the early part of the season, take advantage of specials offered by most battery distributors to buy in somewhat larger quantities, thereby getting a nice reduction on the regular wholesale prices. Don't overload yourself, but do have a fair size stock on hand for the initial rush. Take advantage of any sales devices the battery manufacturer is using in order to attract attention to your shop and enhance battery sales. Make a special display in your window, using dummy batteries, streamers, and any other attention getter you think will be effective (see Fig. 1).

Have a battery checker on hand at the counter and test every battery you sell, right in front of the purchaser. If you have an English-reading scale on your meter showing "Good," "Weak," and "Bad," your customer can understand the test better. Be sure to put your shop sticker or an identifying mark some place on the battery when you sell it. Also, mark it with the date sold. This will protect you from the "shrewdie" who brings a dead battery into the shop and says he "bought it here" a few days ago and insists on a free replacement. If it *is* your battery, then you should inspect his radio for a defective "on-off" switch. But he may have just accidentally left the set turned on at reduced volume.

When putting batteries into a customer's set, check the battery connecting leads for bad connections and corrosion. If the battery compartment is badly corroded from old leaky batteries that were left in the set, suggest that the radio be left for a general inspection. At best, the set is subject to intermittent operation if the battery contacts are corroded.

## Switches

Among the common troubles in portables are defects in the switching circuits. The battery-only portable usually has just an "on-off" switch, but the a.c.-d.c. battery (or three-way) radio has an additional changeover switch to cut in either the batteries or the electric power when operated from commercial lines. In the set that covers more than one band of frequencies, a multiple switch is used to select the desired band.

In the small, personal-type portable radio, operating exclusively on batteries, the "on-off" switch is usually so placed that it is actuated when the lid

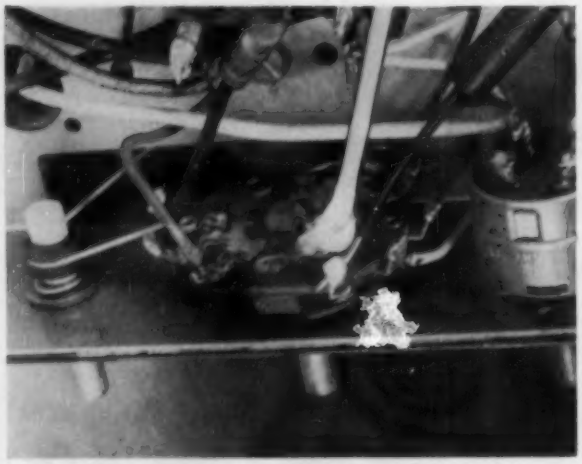


**Fig. 2. Cleaning the contacts on a rotary switch with a pipe cleaner and solvent, such as carbon tetrachloride or alcohol.**

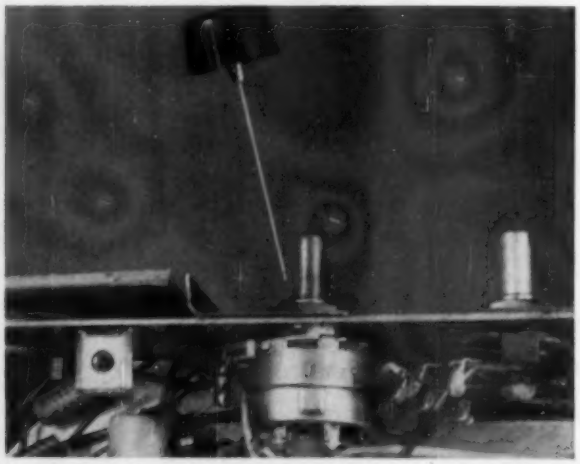
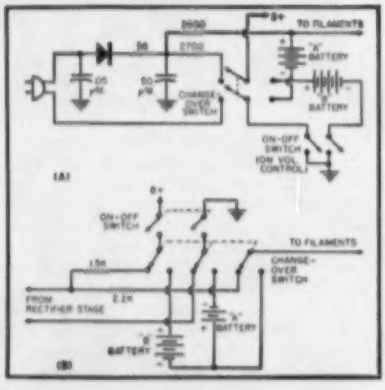


**Fig. 3. Using a long thin dropper to place a few drops of a lubricant-solvent along the shaft of a noisy volume control.**

of the cabinet is opened or closed. Some of these switches are quite fragile with exposed contacts that are subject to accidental bending so that the circuit is not closed when the switch is actuated. Bend the contact gently back into place, taking care it does not break off in the process. These contacts are also subject to corrosion and should be thoroughly cleaned with carbon tet or a similar solvent. Replacement of these switches usually involves some labor because of the compactness of this type of set. Also, exact replacements must be used, and these usually can only be obtained from the manufacturer.

The changeover, or transfer, switch used in the three-way portable takes many forms. On some sets, the changeover may be effected by a double-pole, double-throw switch, or it may be a three-pole, double-throw switch. Quite often the changeover is achieved for battery operation by plugging the power-line plug into a female switching receptacle located on the chassis. For power-line operation, the plug is simply removed from the receptacle (disconnecting the batteries) and plugged into the line. Some manufacturers use rotary switches while others use slide switches to serve the same purpose.

**Fig. 4. Examples of changeover switching circuits used to select battery or power-line operation for three-way portable sets.**




The fundamental troubles on these switches are the same for all types. Either the switch action is defective, indicating complete replacement, or the contacts are bent or corroded so badly that they do not make proper electrical contact. Even if the switch is operating normally, an inspection and cleaning of the contacts, as shown in Fig. 2, with carbon tet will insure continued operation. Fig. 4 shows examples of changeover switching circuits.

Noisy volume controls are also quite common. Of course, these can often be cleared up by using a good lubricant-cleaner. Merely insert a few drops along the shaft of the control, as shown in Fig. 3. Rotating the shaft will help the cleaner to act.

Sometimes loose or broken antenna connections can be a bit of a headache. The set will check out OK with all voltages and everything else normal, but no signal will come out of the speaker. The little personal portables with the lift-up lid are most often subject to this trouble. The antenna is usually mounted inside the lid under a thin plate with its leads soldered to two thin flexible metal strips which extend down into the body of the chassis. With constant opening and closing of the lid, the strips wear through in time, or the soldered connections break off inside the lid and the set immediately becomes noisy or inoperative.

Resoldering open leads is simple, but a broken flexible strip sometimes calls for a little improvisation if a replacement is not right at hand. Sometimes a short length of stranded hook-up wire can serve as a temporary repair.

Sometimes the hinges on the lid serve as the connecting link between the antenna and the first stage. In this case, a defective hinge can cause malfunctioning of the set.

## Tubes

Defective tubes constitute a high percentage of the troubles encountered in portables. Because of the rough handling, they often jar loose, causing inoperation, or intermittent operation. Cracked, broken, and burned-out tubes are quite common troubles. Be careful when installing a new tube in an unfamiliar circuit. A charge might exist on a filter capacitor in the filament circuit, causing immediate burn-out of your new tube or one of the others in the string. This condition is illustrated in Fig. 5 where an open in shunt resistor $R_1$ increased the current in the filament line, causing the filament in $V_2$ to fail. Plugging the set into the power line places a higher than normal charge on filter capacitor $C_1$ because of the open circuit. This charge is retained since no path exists to bleed it off. Installing a new $V_2$ closes the filament circuit and the high charge on $C_1$ is discharged through the tube filaments with resulting burn-out of some tube. This condition is not nearly so prevalent as it was a few years back before the extensive use of properly placed filament shunt resistors, but it is still a wise precaution to remove all the tubes and short all filter capacitors in the line before installing a new tube in an unfamiliar set.

Another cause of tube burn-out is a change in the value of the series resistor ($R_2$ in Fig. 5). Overheating of this resistor lowers its ohmic value, causing an increase in the current flowing in the filament line. Of course, this is true only if the resistor is of carbon composition.

Some filament wiring circuits currently used in portables are shown in Fig. 6. Note the use of protective shunts to maintain uniform flow of current in the filament line and to protect the tube filaments against sudden burn-outs. It is a good plan to make a study of filament circuits in order to expedite troubles originating here.

When troubleshooting a portable set, be sure to check the filament voltages at the tube sockets. A short across the filaments of any one tube would make the set inoperative, but would have no effect upon the over-all operating potentials. Use a v.t.v.m. to measure

these small filament voltages, and be careful where you place your test prods when making tests. It is a good idea to insulate your prods with thin plastic tape right down to the ends, leaving only the tips bare. This will prevent your accidentally shorting out something else in the often cramped little chassis, causing additional damage.

If the series and shunt resistors in the filament line are the flat strip type that mounts on the side of the chassis (in older sets), check for possible shorts between the metal case and the terminal lugs.

While the trend in portable radio circuitry has been toward use of the same output tube for both battery and power-line operation, some sets may be encountered where a 3-volt tube is used for battery operation and a 50-volt tube is used for power-line operation. A partial schematic diagram of this arrangement is shown in Fig. 7. Note the way the output transformer is connected to provide proper load impedances for each tube. In this application, if the set operates on one power source and not on the other, the fault may be in the alternate output stage.

A common culprit in the case of an inoperative receiver is the oscillator tube. Very often the tube checks perfectly in a tube checker, but will not oscillate in the set although everything else is apparently normal. A v.t.v.m. hooked across the oscillator grid resistor will quickly show whether the tube is oscillating. The value of the voltage measured here should be from 8 to 10 volts, negative with respect to ground.

Inserting a new oscillator tube will usually restore operation, but don't be satisfied with just this. The real trouble may be caused by a change in the value of the oscillator grid resistor, $R_1$ in Fig. 8, or coupling capacitor, $C_1$. It could also be a defective oscillator coil, or faulty connections anywhere in the tuned circuit. In this case, your new tube may work satisfactorily until it ages a bit, but it will soon quit and you'll have a dissatisfied customer on your hands until the condition is corrected. If the tube oscillates on the power line but does not on batteries, your batteries may be too weak. However, in all troubleshooting procedures, a test of the operating power source should precede tests in the signal stages.

Where selenium rectifiers are encountered, check them with a high-resistance ohmmeter. For a good unit, the front-to-back ratio should be in the neighborhood of 5 to 1, at least.

Oscillations are sometimes a bugaboo in portables, especially the ultra-compact personals. An open filter capacitor in the filament line is a frequent source of this trouble. Oscillations can also be caused by weak batteries, which should be the first suspect. Because of the compactness of the chassis, a disturbance in lead dress can cause trouble. Also, where the chassis is in two parts a high resistance or open ground between the two sections can be a contributory factor. A screen grid prong broken off in the socket of a pin-type tube (probably when the tube was installed) was one classic example of a hard to find source of intermittent oscillations. Also, an open antenna loop or a high-resistance lead connection can be another cause.

Intermittent operation can be a real headache to trace down. Quite often it is caused by temporary shorts resulting from the extreme compactness of some sets. Be sure to insulate the chassis bottom plate on the inside with tape or thin cardboard cut to fit, to remove this common cause of shorts to chassis. Sometimes prodding all parts and connections with a wooden orange stick or insulated alignment tool (with the set turned on and tuned in, of course) will quickly uncover the cause of the intermittent. Also, in two-section chassis arrangements, pressure against one unit will temporarily show up a hidden short between the two units. Defects in the oscillator stage, already discussed, can also be a cause of intermittent operation.

For routine tests on portable radios, the test procedures that you use on any other radio will apply here as well, and finding and correcting ordinary troubles is not too difficult. A major problem lies in replacement parts. Most of the compact little portables have some special miniature parts that must be procured from the individual manufacturer. It's difficult to decide whether to keep a stock of these special parts because the demand for them is unpredictable. Perhaps the best plan is to contact your distributor and see if he will stock a small supply of the hard-to-get replacements so they are immediately available to you, and to others requiring them. Otherwise, you have no alternative but to order from the manufacturer as the need arises and hope he can deliver promptly. This applies also to the replacement of broken cabinets or parts of cabinets. Usually, these last items can only be procured from the manufacturer.

General alignment methods for portables are similar to those used for other radios. When a loop antenna trimmer is used, it is usually available from the back of the set. Adjust this trimmer for strongest signal at 1400 kilocycles whenever an external antenna is connected. You should remind your customers that weak signals can be expected in areas remote from the broadcasting stations unless an external antenna is used. This can often be just a 10-foot length of antenna pickup wire connected to the short wire lead usually found extending from the loop and intended for this purpose. On some sets, the trimmers on the tuning capacitor must be adjusted with the chassis installed in the cabinet. Usually, a small opening is available in the end of the cabinet to provide easy access to the trimmers.

Many technicians take advantage of the early spring trade by setting up a general inspection plan. For a nominal charge of a dollar or so, depending upon the local rates, they take the radio in for a bench test. Included in the test are checks on batteries, tubes, controls, faulty connections, loose mountings, dial cords and pointers, broken handles, cabinets, etc. In addition, the set is given an operational check on both batteries and commercial power to determine general operating conditions.

This sounds like a lot of service for the price, but actually, the entire series of checks should not take more than a few minutes. Of course, this general inspection does *not* include major repairs, alignment, or parts required for

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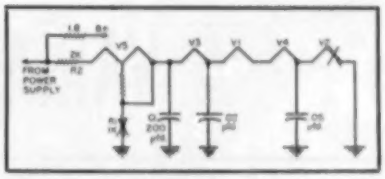



**Fig. 5. Portable radio filament circuit in which an open shunt resister will lead to a burned-out tube and possibly more.**

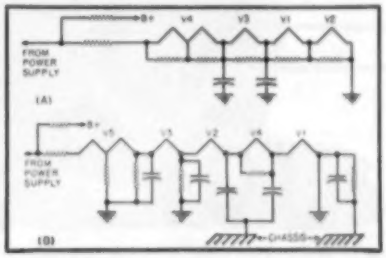



**Fig. 6. Two filament circuit arrangements. Note the extensive use of shunt resistors to prevent tube burn-outs and surges.**

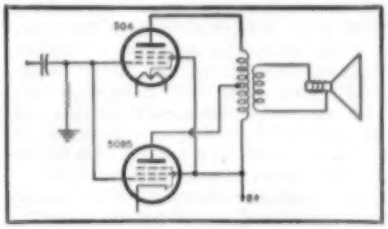
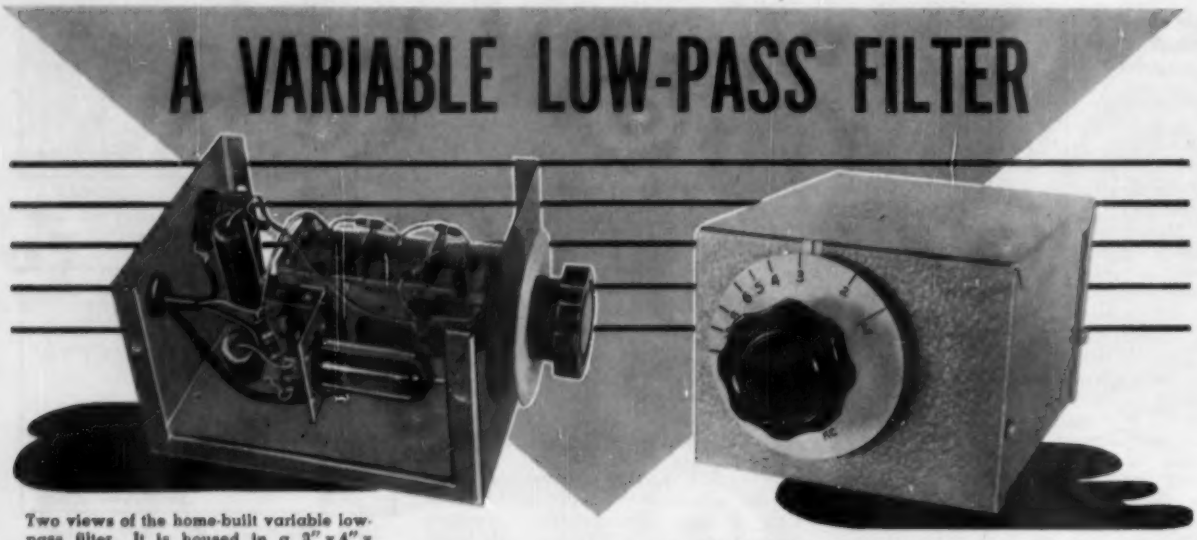



**Fig. 7. Partial schematic diagram of the output circuit of a portable radio using one tube for battery operation (the 3Q4), and another for power-line operation.**

**Fig. 8. Typical oscillator-converter stage. Dead oscillator can be due to change in the values of $R_1$ and $C_1$.**

# A VARIABLE LOW-PASS FILTER



Two views of the home-built variable low-pass filter. It is housed in a 3" x 4" x 5" aluminum utility box which is small enough to be tucked in almost anywhere.

By **LAWRENCE FLEMING**
Consultant

*Build this versatile unit for your hi-fi system or communications receiver at a total cost of $7.50.*

TONE CONTROLS for hi-fi have become quite standardized in recent years. About 15 db boost or cut available at either the bass or the high end, with the crossover at 600 cycles, has shown itself over long experience to be the best simple tone modifier for building into an audio music system.

But there are plenty of other things that one can do to a response curve. The most useful among these is a rather sharp high-frequency cut-off, obtained with a low-pass filter. With perfect program material, such filtering is not needed, but with much of the program material from broadcast tuners and discs the low-pass will discriminate against noise and hash much better than a regular treble control. Such 9 kc. low-pass filters have been used very extensively, for example, in movie theater sound systems, as giving the best compromise between best fidelity and background noise on the sound track.

The trouble with a low-pass filter of standard design is that it has to be built for a specific cut-off frequency and cannot very well be made variable. A set of such *LC* filters is rather costly, since the special inductances required cost at least five dollars each.

Variability is quite necessary in hi-fi work. An old scratchy disc may sound best with a 5-kc. cut-off, but with a tape or a good LP record we need a little dial on the filter with which the cut-off frequency can quickly be run up to 15 or 20 kc.

Such a variable filter has another use: it makes an excellent high-frequency-response tester for the whole sound system, including the record. Merely crank the dial down until the degradation in music quality is just noticeable. The dial reading will then tell about what the top frequencies are in the signal. For a speaker previously measured as starting its high-frequency cut-off at 8500 cycles, for example,[1] this listening test with the filter gave an answer of 8 kc.

The range of cut-off frequencies available with this filter makes it applicable to ham communication as well as to public address and hi-fi work. High cut-off settings of around 8 to 10 kc. will help to take the "edge" off of sound from records which have roughness on loud passages, much more effectively than the usual tone control. A cut-off setting of around 4 to 6 kc. is helpful in playing old 78 rpm records. A 2 to 4 kc. cut-off is useful in ham communication. Here the filter may be inserted ahead of the last audio stage in a communication receiver, since it will handle around 15 volts of signal without overload; or it will work nicely in the speech amplifier system of a phone transmitter.

**Table 1. Characteristics of the home-built variable low-pass filter.**

| | |
|---|---|
| **Cut-Off Frequency:** | **1700 cycles to 20 kc., continuously variable** |
| **Attenuation Rate:** | **18 db per octave** |
| **Type:** | **Low-pass only** |
| **Input Impedance:** | **400,000 ohms (approximately)** |
| **Output Impedance:** | **15,000 ohms (approximately)** |
| **Normal Operating Level:** | **1 volt** |
| **Hum and Noise:** | **200 microvolts (70 db below 1 volt)** |
| **Gain:** | **1** |
| **Tube Complement:** | **6C4 tube** |
| **External Power Required:** | **6.3 volts a.c. @ .15 amp.; 150-300 volts d.c. @ 2-4 ma.** |

### Performance

Since it is not practical to make the necessary chokes and capacitors variable in a conventional *LC* filter, circuits have been developed in which tubes are hooked up with variable *RC* filters to give sharp cut-off characteristics as good as those obtained with chokes. Excellent and versatile wide-range variable filters of this sort are sold commercially for a few hundred dollars each.

The filter shown in the photographs costs $7.50 for parts, including cabinet and dial. In versatility this little gadget does not compare, of course, with the store-bought laboratory instrument, nor is the shoulder of the cut-off curve as sharp. But it is stable, reliable, effective, and quiet, and hum and noise are 70 db below normal operating level.

Characteristics of the filter described here are given in Table 1.

The unit is designed to fit in between a hi-fi preamplifier and the main amplifier, borrowing its power from the other amplifiers after the fashion of the little preamps sold for use with *G-E* phonograph pickups.

### Response Curves

Fig. 2A shows the response taken at typical points along the scale of the "tuning" dial. The response is, in general, flat within ½ db up to about 80% of the cut-off frequency. Cut-off frequency is here given the usual defini-

tion of the frequency where the response is 3 db down. On the low end, the response is flat down to 25 cycles, and down 1 db at 10 cycles.

The shoulder or "break" of the curve where the response really starts down is slightly rounded, but not enough to affect the results discernibly for listening purposes. At settings below about 10 kc. there is a slight rise in response just before cut-off, of 1 db or less; this is unavoidable in the type of circuit used, but the effect on the ear is undetectable. When the program material is good enough, the dial will be cranked all the way up to 20 kc. anyway.

## Circuitry

The principle of the circuit is simply that of an *RC* filter with its effective "*Q*" stepped up by means of a tube amplifier stage and a feedback connection. The effect of the tube on the response is shown in Fig. 2B. Curve 1 shows response or transmission characteristic of the *RC* filter alone, at an intermediate dial setting. It is exceedingly gradual and droopy, hardly worthy of the name of a filter. Curve 2 illustrates the same *RC* filter at the same dial setting, with the 6C4 tube in operation and the feedback connection completed. The curve now resembles fairly well the characteristic of a classical *LC* filter.

Fig. 1 is the complete circuit diagram. The *RC* filter circuit is simply made of three resistors and a 3-gang t.r.f.-type broadcast tuning capacitor. The output of the *RC* filter goes to the grid of the 6C4 tube; output of the complete device is taken from the plate of this tube. The feedback connection runs from the output back to the input of the *RC* filter *via* the 680,000 ohm resistor $R_5$. A 2.2 megohm grid leak completes the d.c. circuit to ground for the grid of the 6C4.

There is nothing critical about any of the circuit constants or supply voltages. Standard ±10% tolerance resistors are satisfactory. The unit works equally well at plate supply voltages of 150 or 300. Plate supply voltage should be well filtered. Since the current drain is small, 2 ma. at 150 volts (4 ma. at 300 volts), the voltage can usually be "stolen" from the supply for the preamp or one of the voltage amplifiers. If extra filtering is necessary, use a 4700 ohm ½-watt resistor and a 20 μfd. electrolytic.

The gain of the unit is determined by the ratio of $R_3$ to $R_4$. If they are equal, it will be slightly less than 1. The gain should be within 30 per-cent or so of 1, in order that the feedback factor will be somewhere near the right value to do a good job of squaring up the response curves.

The impedance of the signal source should not be too high. 200,000 ohms source impedance is the top limit, and around 50,000 ohms is better. Too-high source impedance will not only drop the gain, but it will round-off the shoulder of the response curves and make the actual cut-off frequencies lower than the dial reading. The effect on calibration is negligible at source impedances lower than 100,000 ohms. Since practically all preamp circuits have an output impedance lower than this, there should be no trouble.

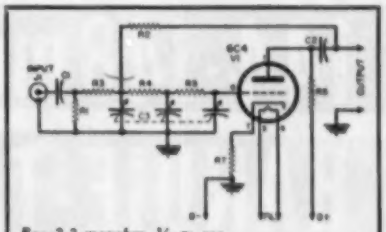
## Construction Details

The model shown in the photos was built in a 3"x4"x5" aluminum utility box. The tube socket is mounted on a home-made bracket which is screwed to the tuning capacitor frame. Thus most of the wiring can be done before the capacitor tube assembly is mounted in the box, although actually there is plenty of room to do it afterward. The tuning gang is mounted directly to the front "panel," for which purpose it was necessary to run a 6-32 tap through three small holes which were already present on the front of the capacitor frame. Lead dress is unimportant, since the signal level is high and the gain low.

The input terminal is a regular *RCA*-type phono jack on the back, and the output a phono plug on the end of a couple of feet of shielded wire.

The dial is a 2½ inch dial plate which happened to be handy, screwed to the back of a regular 1⅝" instrument knob. The dial plate was painted (auto enamel or most any kind of paint will do), then degreased by swabbing with a hunk of Kleenex dipped in household ammonia, then lettered with India ink. Over this, clear lacquer.

The calibration was made using an audio oscillator and a *Heathkit* AV-2 audio voltmeter, the original points on the dial face being marked lightly in pencil.




*$R_2$—2.2 megohm, ½ w. res.*
*$R_3$—680,000 ohm, ½ w. res.*
*$R_4$—470,000 ohm, ½ w. res.*
*$R_1$, $R_5$—220,000 ohm, ½ w. res.*
*$R_6$—47,000 ohm, 1 w. res.*
*$R_7$—1200 ohm, ½ w. res.*
*$C_1$, $C_2$—.1 μfd., 400 v. capacitor*
*$C_3$—Three-gang t.r.f.-type tuning capacitor, 365 μμfd. per section*
*$J_1$—Phono input jack (RCA type)*
*$V_1$—6C4 tube*

**Fig. 1. Complete schematic of the variable low-pass filter. Standard, non-critical parts may be used in its construction.**

Lacking an AV-2, use the low a.c. range on a *Voltohmyst*, *Heathkit* V-7, or similar v.t.v.m., but be sure the instrument is the type that uses a diode rectifier for a.c., not the older type with 1000-ohms-per-volt a.c. ranges using a copper oxide rectifier. These disc rectifiers are only good up to about 3000 cycles at best. For this reason the a.c. ranges on most regular voltohmmeters are no good for the purpose.

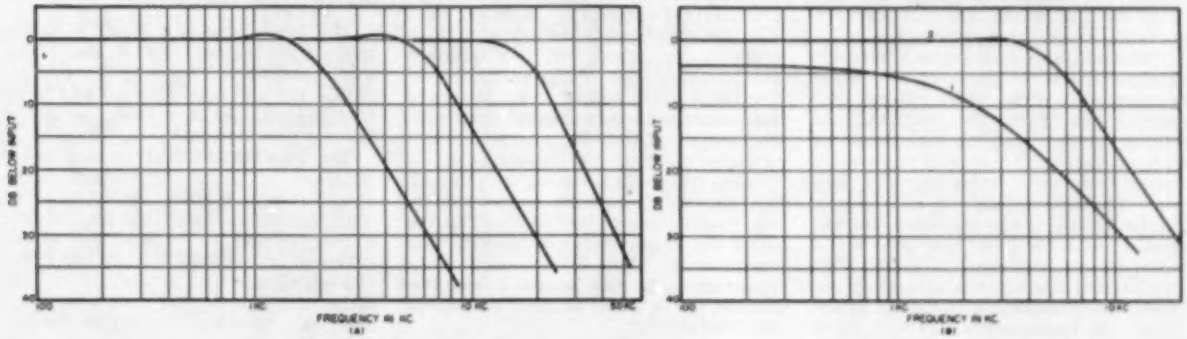
Lacking everything but an oscillator, which is indispensable, connect the just-completed filter to the main audio amplifier and improvise an output meter. Merely hang across the voice coil terminals a 1-ma. d.c. meter, a 1N34 or any other type of germanium crystal diode (not a disc rectifier), and a 1000-ohm resistor, all in series. Lower-range d.c. meters will do; increase the series resistance proportionally, *e.g.*, 10,000 ohms for a 100-microamp meter.

## Filters in General

Any type of filter affects the transient response of a system, and the sharper the cut-off the worse the effect. The primary purpose of a low-pass filter in audio work is to better the signal-to-noise ratio. In cases of noise like needle scratch on shellac records,

(*Continued on page* 101)

**Fig. 2 (A) Response characteristics of the filter at dial settings of 1.8, 6, and 17 kc. (B) Curve 1 shows the response characteristics of the RC filter circuit alone while Curve 2 is the response of RC filter plus the tube circuit.**



# 144-148 mc. HANDIE-TALKIE

By H. F. PRIEBE, JR., W2TGP

*A compact, two-meter band unit which is ideally suited for CD work since it measures just 10½ x 3 x 1½ inches.*




**Front and rear views of the home-built handie-talkie. Since this equipment operates in the two-meter amateur band, it can only be operated by a licensed ham radio operator.**

HANDIE-TALKIES have made a fine contribution in our war effort and have found extensive application in the Armed Services. However, the military were not the only ones to recognize their value. Various commercial interests have found this means of communication indispensable.

Handie-talkies are complete self-contained radio sending and receiving stations. They contain, in a single housing, the transmitter, a receiver, and dry batteries for power. The microphone, earphone, and the antenna are mounted on the exterior of the housing. The complete unit is compact enough to be held in one hand and operated in much the same fashion as an ordinary telephone handset.

The completeness of the handie-talkie makes maintenance as well as operation easy. There is no additional equipment to plug in, to attach, or to worry about bringing along. This is very important when considering emergency operation.

The writer can recall instances when a portable transmitter-receiver unit was hurriedly taken to the portable site to find on arrival that the microphone or the headphones were left behind and a second trip was necessary.

There are numerous everyday uses for the handie-talkie, one most of you will appreciate is aiding in TV antenna installation and maintenance. Civil Defense and other emergency services have varying needs for hand-carried, portable transmitter-receivers.

The conditions under which portable equipment must operate are often overlooked in many cases. Hams who have operated mobile stations can readily understand the handicaps of such operation. There are three main obstacles to such operation and they are: (1) Antenna site. It is of course right where you are standing and seldom, if ever, is it a spot you would select for an antenna. (2) Low power. Dry battery operation is extremely low power when compared to mobile equipment. (3) Interference. Usually there are noise and distractions that make operating difficult.

A difficult, if not impossible, task is to fix a performance figure for such units as these handie-talkies. A desirable statement would be to say that these units will maintain reliable communication over a specific distance. To explain, here are the two extremes: The maximum distance between two of these units is slightly over one mile. This is unobstructed line of sight distance. The minimum distance if we take the example of one unit being enclosed in a screen room where the attenuation may be 100 db or greater, is zero. And of course if the communication is between a fixed station with good location and equipment, and one of the handie-talkies, the distance may be many miles.

A separate tube and components are used for the oscillator and detector rather than using a common stage and changing its operating conditions accordingly. Such units that use a single tube for both functions are called transceivers. Separate stages are used for the following reasons: (1) With transceivers when working another similar unit they will "walk" across the band. This happens as a result of the continuous retuning of each unit because the frequency of transmission is different than the frequency of reception for a single tuning adjustment. (2) The use of separate stages permits the transmitter to be "spotted" in the band on a particular frequency and complete freedom of the receiver is maintained. It may be tuned from one station to the other without disturbing the transmitter.

A push-to-talk button was used merely for convenience. A 3-pole, 2-position slide switch would perform better electrically but would not permit this operating ease.

### The Transmitter

The r.f. section of the transmitter uses a single 958A acorn tube in a self-excited oscillator circuit. The oscillator tuning capacitor is adjustable from the exterior through a small hole in the case. In the photograph showing the unit with its back cover removed the oscillator tank circuit can be seen in the upper right corner and the oscillator tube in the upper left. Although a modulated oscillator is used in the transmitter the stability is adequate for reception on most superhets.

The modulator is a 3A4, which is the common audio stage to both transmitter and receiver. Adequate power output is obtained with the single button microphone and microphone transformer as excitation for the tube. Voltage for the microphone is supplied by the "A" battery.

The headphone also doubles as the modulation reactor when in the "transmit" condition. This arrangement includes the sidetone with no additional components. As a matter of fact it saves a plate reactor.

The bias for the 3A4 audio stage is obtained by using the voltage developed across a resistor placed in series with the "B" supply. This may, at first glance, appear to be wasteful of the precious "B" supply voltage but it has the advantage that as the "B" voltage drops the bias to the 3A4 also drops and has an averaging effect on the out-

put. Of course, too, it eliminates the "C" battery.

### The Receiver

A second 958A tube is used in the receiver as a superregenerative detector. A single stage of audio amplification follows the detector to provide sufficient headphone volume. The audio stage is the 3A4 mentioned previously. The amount of radiation from the detector is not excessive but it does exist as with all regenerative detectors.

### Mechanical Construction

The case is made of 18 gauge aluminum; its dimensions are 10½ inches long, 3 inches wide, and 1½ inches deep. A total of 4 small brackets is necessary to mount the two tuning capacitors, the audio tube, and form a partition for the battery section.

The receiver tuning and the transmitter frequency adjusting capacitors are of the APC type. All except one rotor and one stator were removed from 25 $\mu\mu$fd. capacitors for each of the two stages. An insulated shaft extension is modified to fit firmly over the hex adjusting screw on the capacitor shaft.

Looking at the rear-view photograph, we see the transmitter oscillator is at the top and the receiver detector is at the lower right just above the battery section. "The "send-receive" switch is between the receiver and the battery sections. The common audio stage is to the left of the receiver and the "on-off" switch is directly underneath. In between the transmitter and receiver sections can be seen the transformers. The microphone and audio coupling transformers are in the single case. The particular transformer unit shown in the photographs was obtained on the surplus market. They have commercially available equivalents, which are for the microphone transformer a *UTC* "Ouncer" O-1 and the other, used as an audio coupling transformer, is a *UTC* "Ouncer" O-9.

The antennas were also obtained in the surplus market and the exact origin not known. Their length is 18 inches. A discarded indoor TV antenna such as the familiar "rabbit ears" would supply the necessary material for making your own. The preferred antenna length is 19 inches.

The batteries are a 67½ volt battery such as the "Mini-Max" or *Eveready* 467 for the plate supply and a single 1½ volt flashlight cell for the filaments or "A" supply. The connections and mounting of the "A" battery make possible the measuring of its voltage without removing the back cover of the unit. The life of the "B" battery is much longer than the "A" battery.

The push-to-talk switch was made from a standard d.p.d.t. push-button type switch. It was necessary to add a pair of contacts to provide the "make."

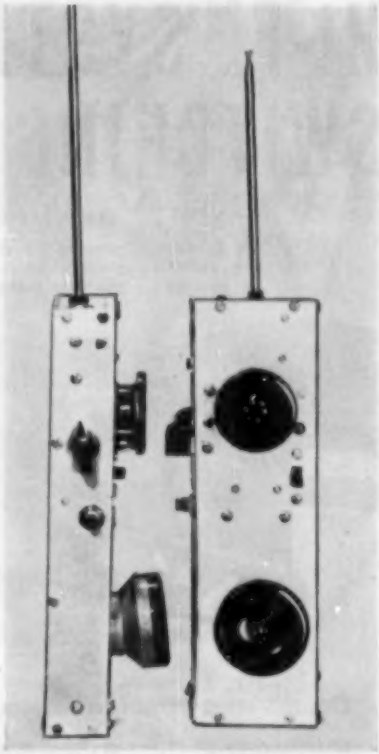
The radio frequency chokes are made of #32 enamel wire wound to a length of 1¼" on a ⅜" diameter insulating rod. If there is any question as to whether they are of sufficient inductance they can be checked when the units are put into operation. Touching the "cold" end of the chokes with your finger should have no effect on detector regeneration or in case of the oscillator no effect on oscillation.

The microphone is of the T17 variety. The slope of the microphone, similar to a telephone handset, was obtained by sawing at an angle when the microphone is removed from the push-button and handle. Two mounting holes are drilled and tapped in the microphone housing. If desired the microphone (and headphone) could be obtained from a regular telephone type handset in a similar manner.

### Interstage Coupling

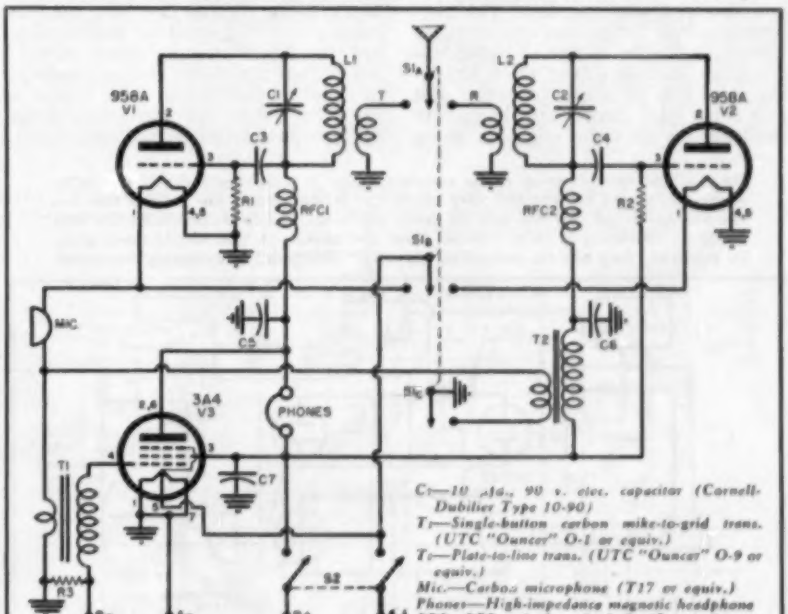
A transceiver transformer of the desired size was unavailable at the time these units were constructed so the novel connection of two transformers as shown in the schematic diagram was used. If the builder can obtain a suitable transformer the circuitry can be simplified somewhat.

In closing, the author wishes to point out that this equipment *cannot be operated* by anyone not holding the *pertinent amateur radio license*. Sorry, fellows, but that is the way the matter stands and we sincerely hope that no one will run afoul of the law and the FCC by building and using this gear if he is not entitled to such amateur radio operating privileges. Finally, this equipment cannot be adapted and used on the Citizens Band. -30-



**Front and side views of the handie-talkie. The antenna was a surplus item but a TV antenna of the "rabbit ears" type can be used as well. See text for full details.**

**Complete schematic of the handie-talkie. The 3A4 is common audio stage for both transmitter and receiver. Single-button mike obtains its current from the "A" battery.**




*$R_1$—10,000 ohm, 1 w. res.*
*$R_2$—1 megohm, ½ w. res.*
*$R_3$—560 ohm, ½ w. res.*
*$C_1$, $C_2$—25/25 $\mu\mu$fd. APC var. capacitor (Modified, see text)*
*$C_3$, $C_4$—50 $\mu\mu$fd. mica or ceramic capacitor*
*$C_5$, $C_6$—.006 $\mu$fd. mica capacitor*
*$C_7$—10 $\mu$fd., 90 v. elec. capacitor (Cornell-Dubilier Type 10-90)*
*$T_1$—Single-button carbon mike-to-grid trans. (UTC "Ouncer" O-1 or equiv.)*
*$T_2$—Plate-to-line trans. (UTC "Ouncer" O-9 or equiv.)*
*Mic.—Carbon microphone (T17 or equiv.)*
*Phones—High-impedance magnetic headphone*
*RFC1, RFC2—4 mhy. r.f. choke (See text)*
*$L_1$, $L_2$—7 t. #14, ¼" dia. spaced to occupy ⅜". Two turn antenna coupling link for $L_1$ and single turn link for $L_2$*
*$S_1$—D.p.d.t. push switch with added "make" contact (See text)*
*$S_2$—D.p.d.t. slide switch*
*$V_1$, $V_2$—958A acorn tube*
*$V_3$—3A4 tube*

# HI-FI SYSTEM SWITCHING ★★

By **WILLIAM VISSERS**

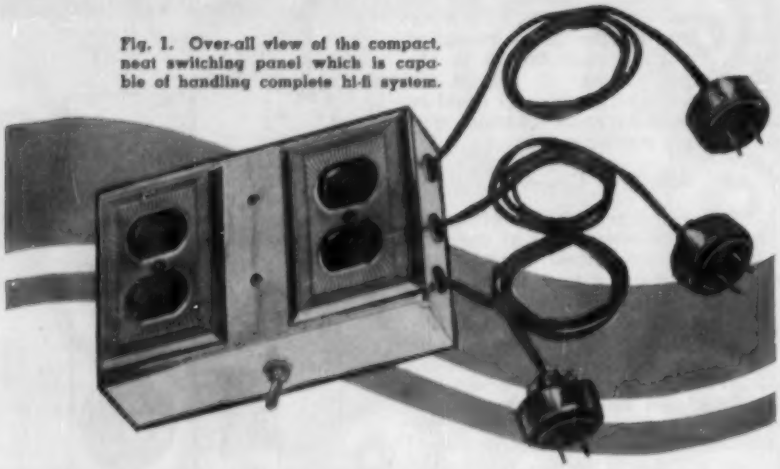


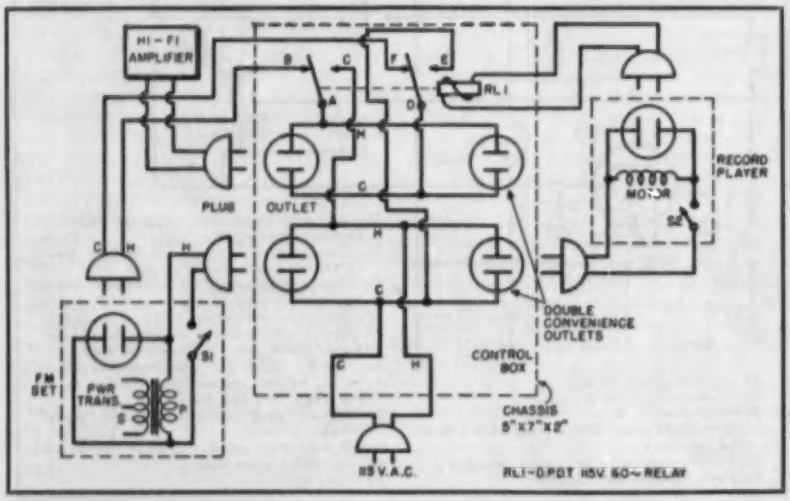
**Fig. 1. Over-all view of the compact, neat switching panel which is capable of handling complete hi-fi system.**

*Details on a versatile switching system which can be used with many of the existing home high-fidelity installations.*

DURING the past year the writer, like an increasing number of others, was bitten by the high-fidelity bug. The eventual upshot was the purchase of an amplifier, FM tuner, record changer, and speaker. The performance was far beyond expectations, except for one thing. The plugging, unplugging, and switching when changing from FM to phono operation and *vice versa* were complicated enough to challenge an electrical engineer, much less the distaff side of the household, who seemed quite loath to study electrical circuit switching just to be able to turn on the radio or phonograph.

A visit to several friends who owned hi-fi systems showed that they too had encountered this problem. Mostly, they had developed various small switchboards, but often with enough switches to make an instruction book almost a necessity before the equipment could be turned on or off by the uninitiated.

**Fig. 2. Schematic diagram of the switching unit. It is important that the polarity of the a.c. wiring be watched very carefully. In most cases the 115-volt line has one side grounded and this must be taken into consideration when wiring this unit. It will be necessary to color code all plugs and sockets so that should these plugs be removed, they can be re-inserted properly. This point is extremely important!**




It was soon decided that something should and would have to be done to simplify the operation of our equipment.

After some thought it was decided that the most satisfactory system would be one that would allow the FM to operate into the amplifier with only the FM "on-off" switch as a control. In addition, the record player should operate into the amplifier with only the record player "on-off" switch as a control. And, finally, when the last record on the stack had been played, the record player shut-off switch should also turn off the amplifier. This last item was deemed necessary since we once found the amplifier running some two days after the record player had turned itself off. This system of automatic control now allows us to put on a stack of records, retire for the night, and be lulled to sleep by our favorite music without having to get up to turn off the amplifier after the records have been played.

Although the switching circuit was developed for the equipment used by the writer, the circuits are general enough to be readily adapted to any equipment. The power switching circuit is shown in Fig. 2, with a photograph of the switch box shown in Fig. 1. The record player is a *Garrard* three-speed Model RC 80. This player, like most others, has an automatic motor cut-off switch, which turns off the motor power after the last record has been played. The record player modification consisted of connecting a 115-volt lamp cord and convenience outlet across the motor terminals. The outlet is mounted on the record player base. This outlet supplies the power to operate relay $RL_1$, which is the heart of the switching unit.

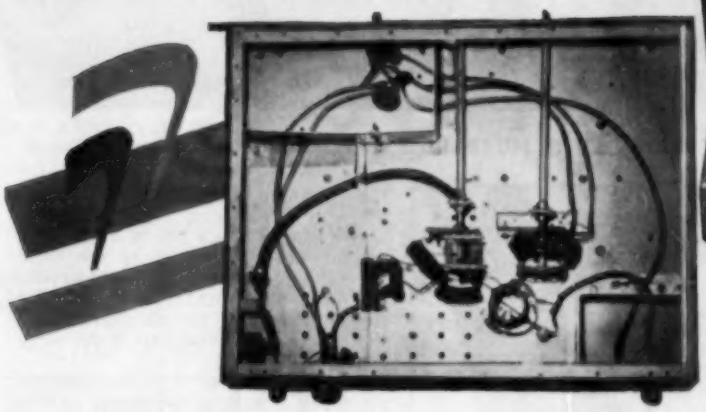
The FM unit had the conventional amplifier power outlet which is energized with line power when the FM set is turned on. This outlet can be added to any FM set not so supplied by connecting a convenience outlet across the FM power transformer primary winding.

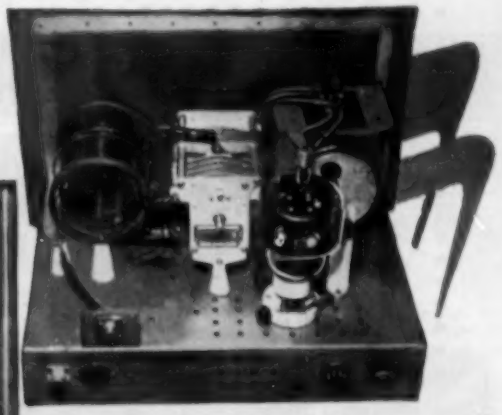
Operation of the switching unit is as follows: All of the units are plugged in as shown, and the relay box plugged into the 115-volt a.c. power line. With both the FM tuner and the record player turned "off," the audio amplifier has no power applied. When the FM set is turned on, power is routed to the amplifier through the FM power line switch $S_1$, and contacts *AB* and *DF* of relay $RL_1$. This allows the FM set to turn on the audio amplifier. With the FM set turned off and the record player switch turned to "on" position, the following switching action takes place. Power is applied to the relay coil through switch $S_2$. The relay $RL_1$ is energized, and the amplifier now receives power through contacts *AC* and *DE*. When the last record has been played, the automatic switch $S_2$ on the record player opens, turns off the record player motor, and de-energizes the

(*Continued on page* 152)

# A TWO-BAND FINAL

By **R. H. MITCHELL, W5DWT**





Two views of the two-band final. The chassis and cabinet were constructed of Reynolds "Do-it-Yourself" aluminum.

*Details on a completely TVI-proofed final for 1 kw. input on 7 and 14 mc. It is ideal for contest work.*

LET'S face it. With the shielding required in today's "TVI-treated" transmitters, plug-in coils are virtually valueless as a means of rapid bandchanging. I had to face this problem, as my pet activity in ham radio is contest work. Unfortunately, I had added shielding gradually to my rig until it took me half an hour to change bands. As any contest operator knows, the new band always goes out in that period.

My first notion was to build a 3.5 to 28 mc. tetrode final, using complete one-knob bandswitching. However, reason and finances prevailed, and the rig shown in the schematic diagram was the simplest solution. My old triode final could be left on any one band, and only three other bands were needed, since 28 mc. hasn't been worth wasting power on recently. Too, I had a perfectly good 150-watt output, all-band transmitter to use as a driver for any legal triode final, so excitation was no problem. Finally, triode amplifier parts and a fair supply of 304TL's were available.

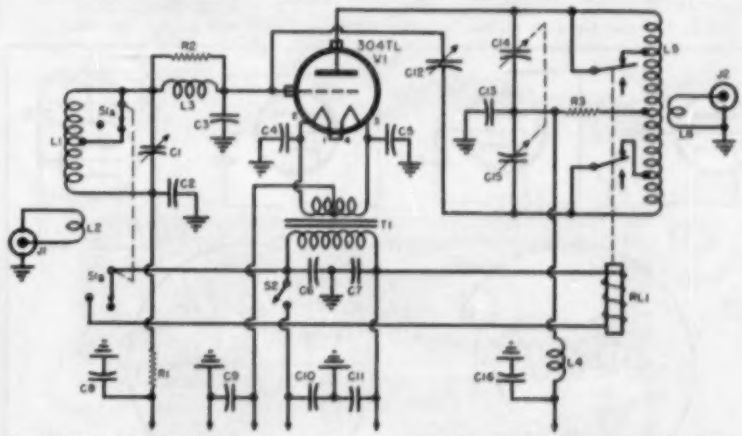
Consequently, it was decided to use the old rig on 3.5 mc. only, and to use a 304TL in the new final for 7, 14, and 21 mc. First plans called for a tapped grid coil on all three bands. A suitable plate-circuit switch was not available, so, with some misgivings, a d.p.d.t. "antenna" relay was used to short out the plate coil. The relay was to leave the entire plate coil in the circuit on 7 mc. On 14 and 21 mc., the relay was to short out enough turns of $L_6$ to permit tuning 14 mc. near maximum capacity, and 21 mc. near minimum capacity of $C_{14}$-$C_{15}$. This was an excellent idea, but it developed that 5 $\mu\mu$fd. more maximum capacity, or 5 $\mu\mu$fd. less minimum capacity was required to do the job. So, this became a two-band final covering 7 and 14 mc. A 70 $\mu\mu$fd. per section capacitor at $C_{14}$-$C_{15}$ should permit coverage of both 14 and 21 mc. at one tap setting.

Construction of the final was straightforward. All wiring, other than r.f. wiring and filament leads, was made with shielded wire. RG-8/U was used for high-voltage leads. All wire shields were grounded on each end and at all points where they pass through shield

(*Continued on page* 146)

**Complete schematic diagram and parts list covering the 7 and 14 mc. (2-band) final amplifier.**

*$R_1$—100 ohm, 5 w. wirewound res.*
*$R_2$—Part of Ohmite P-300 parasitic suppressor (See text)*
*$R_3$—100 ohm, 20 w. wirewound res.*
*$C_1$—100 $\mu\mu$fd. variable capacitor, .03" spacing*
*$C_2$—.002 $\mu$fd. 1200 v. mica capacitor*
*$C_3$—25 $\mu\mu$fd., 7500 v. r.f. type ceramic capacitor (See text)*
*$C_4$, $C_5$, $C_6$, $C_7$, $C_8$, $C_9$, $C_{13}$, $C_{17}$—.005 $\mu$fd., 600 v. ceramic disc capacitor*
*$C_{10}$—2-12 $\mu\mu$fd. neutralizing capacitor*
*$C_{11}$—Two parallel-d 500 $\mu\mu$fd., 10,000 v. ceramic capacitors*
*$C_{14}$-$C_{15}$—50/50 $\mu\mu$fd., 7000 v. variable capacitor*
*$C_{16}$—500 $\mu\mu$fd., 10,000 v. ceramic capacitor*
*$L_2$—14 t., 1¼" dia., 1¼" long, tapped at 6th t. from cold end*
*$L_3$—2 t. at cold end of $L_2$*
*$L_4$—Part of Ohmite P-300 parasitic suppressor (See text)*
*$L_5$—28 t. #22 en., closewound on ¼" form*
*$L_6$—40 meter plate coil, tapped 3 t. each side of centertap*
*$L_7$—1½ t. link wound $L_6$, adjusted for best coupling on both bands*
*$J_1$, $J_2$—Coaxial jack*
*RL1—D.p.d.t. "antenna relay" (Advance 400, see text)*
*$S_1$—D.p.d.t. ceramic switch*
*$S_2$—S.p.s.t. toggle switch*




*$T_1$*—Fil trans. 10 v. @ 12.5 amps.*
*$V_1$—304TL tube*

** Note: Since this transformer is apparently not a standard item in jobber catalogues it would be necessary to have one made up on a custom basis to meet these exact specifications, however, two 5 volt, 13 amp. filament transformers (Thordarson 21F06) could be used in series to provide the necessary voltage and current.*

# A MOST UNUSUAL OSCILLATOR

*Not new—but novel in that vacuum tubes are used as oscillators without using any form of a "B" supply. The only power required is to heat the tube filament.*

By **HAROLD C. HUBBARD**



The author shows tuning up his electric guitar. The electronic tuner visible on top of the speaker cabinet is the one covered in the text. It is designed simply as a tuner. See text for explanation.

EDITOR'S NOTE: *This article should be of considerable interest to those who like to experiment in that the ideas covered can be applied in so many different ways. Basically, the author covers a form of oscillator that can be applied to various types of test equipment and particularly to musical instruments. The article presents an idea and is not intended to cover complete construction details on any specific piece of equipment.*

PROBABLY no single piece of equipment is more interesting and useful to the experimenter, radio technician, and those who work in audio than an oscillator. Such circuits seem to be necessary in working with everything from electronic gadgets to electronic music.

The search has always been for a circuit that would satisfy the requirements of small size, low cost, and good stability.

This article will describe such a device on which patents are pending, and will contain many surprises to the worker familiar with the circuitry of tube oscillators.

A vacuum-tube oscillator, no matter how small or how cleverly designed, has always had the lines labeled "To B Supply" sneaking out toward the border of what otherwise would have been a perfect picture of a small, inexpensive unit. It leaves the reader with the same feeling as when he becomes interested in a miniature one-tube portable pocket radio only to find a single wire leading out of the schematic labeled "To a 100 ft. ant."

Also, this "B" supply to the oscillator cannot be just any supply around the house since fluctuations in such a supply will affect the amplification of the tube and the stability of the oscillator.

So it would seem if we dropped our plate power supply, we would gain in stability: we could forget high voltage power transformers, filters, rectifiers, regulators, and the space for and expense of these items.

With a tube this seems impossible, because ever since De Forest used a "B" battery we have been taught that there must exist some force which overcomes the atom's attraction for the electron, *i.e.*, a high positive potential on the plate. Also, this voltage determined the velocity and, to a great extent, number of electrons leaving the vicinity of the cathode.

Everything built today is a new "concept" of the thing originally built, from automobiles to the simplest gadget, so the word will not be out of place here. Let's look at a "new concept" of working a simple tube oscillator using no "B" supply and with a.c. on the filament.

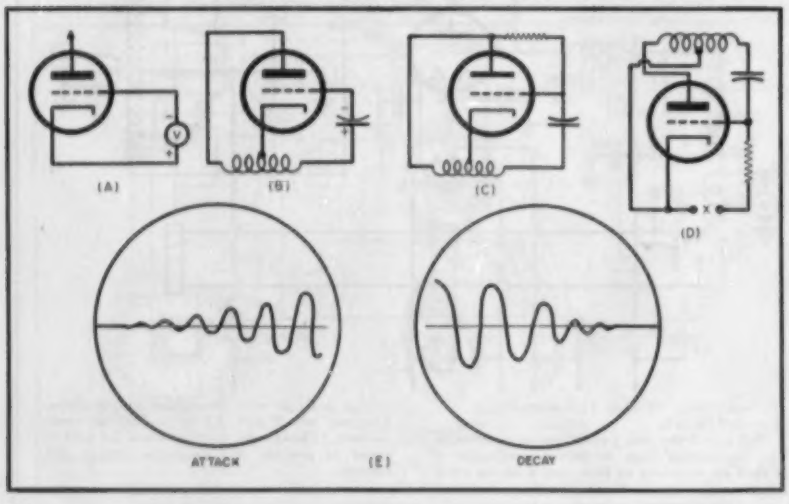
When a cathode is heated to the saturation point, electrons are emitted at a precise rate (Richardson's Equation). Without a high potential on the plate to affect their velocity or number they leave by thermal agitation alone until the space charge limits their movement.

The pressure can be measured between grid and cathode and the cathode will be found positive by the number of electrons it lost. (Fig. 1A.) If a capacitor is substituted for the voltmeter these charges will be placed upon its plates. Adding inductance we have the circuit shown in Fig. 1B. The cathode and plate are at the same positive potential with the grid negative.

By adding a resistor to discharge the capacitor, it can be seen these potentials will oscillate as the capacitor charges and discharges. Inasmuch as this resistor is simply to discharge the capacitor, it can be connected from the grid to any part of the circuit and as it's convenient it will be shown connected to the plate. So the basic circuit becomes that of Fig. 1C.

In this circuit the electrons move

**Fig. 1. Basic circuitry of the "unusual oscillator." See text for full details.**



from cathode to grid, and from grid to plate due to oscillating counter electromotive forces in the inductance due to the capacitor discharging through it and the final movement of the cloud is from the plate back to the cathode. If the inductance is tuned by a capacitor then the *LC* circuit acts as an escapement movement, the counter electromotive forces acting at the resonant frequency of the tuned circuit. Thus we have an oscillator with no electrically connected outside source of power to affect its stability.

It will be appreciated that this electron pressure could be devised by means other than thermal agitation.

Due to the circulating currents in a resonating circuit being many times greater than the pulses causing them, a signal of sufficient strength to activate a pair of cheap phones is gained even though the take-off is with a 16-ohm secondary of a standard output.

The secondary could have a greater number of turns and a greater output voltage until enough power was drawn from the oscillator to affect the counter electromotive forces developed. In such a case, the low frequencies would fade first.

Some readers may notice that the circuit looks like a Hartley, but there are many notable differences. A few points of comparison are; the Hubbard oscillator does not start with a plate current flow in the usual sense—the power supply is out in space in the form of a cloud. In the described oscillator the frequency is controlled by the *LC* circuit, the grid capacitor and resistor having small effect on the frequency. In a Hartley using the same parts, the frequency, except under certain conditions, will depend upon the time constant of the *RC* circuit in the grid. The tube will act as a relaxation oscillator with the output waveshape any number of variations, depending on the value of grid capacitor and resistor and, to a lesser extent, on *LC*.

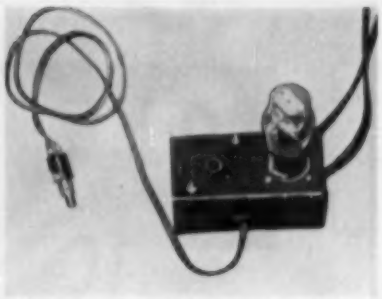
The output waveshape is always the same irrespective of the value of grid *R* and *C* in the writer's oscillator. It has covered from 30 cycles to above the broadcast band in r.f. frequencies all on the same value of grid *R* and *C*. (Any tone quality or waveform containing either odd or even harmonics can be produced by a tuned lumped inductance in the grid circuit and that quality will remain fixed throughout the range of the oscillator.)

Lastly, the Hartley is useless as a tone generator for electronic music. It is very unstable even with a regulated power supply and will not produce good sine waves but waves of sharp needle points.

It is in this field that the present oscillator shows up very well. Not only for stability but by the fact that if a key contact is inserted at *x*, as shown in Fig. 1D, signal build up and decay will be a function of the value of the grid capacitor and the frequency generated. With ordinary values it is possible to get gradual attack and decay which shows up nicely on the oscilloscope screen and is similar to that obtained by Baldwin with resistance keying. See Fig. 1E.

Inasmuch as there is no potential difference between the plate and the cathode, the tube doesn't amplify and there is no rush of plate current at the time the key is closed. The cheapest contact switch can be used yet gives a beautiful attack and decay to a signal of any frequency. This, plus the fact that these tone generators can be locked together very easily in octave relationships with no problem involving precise voltage values to keep them dividing, solves many of the headaches in the home construction of electronic musical instruments.

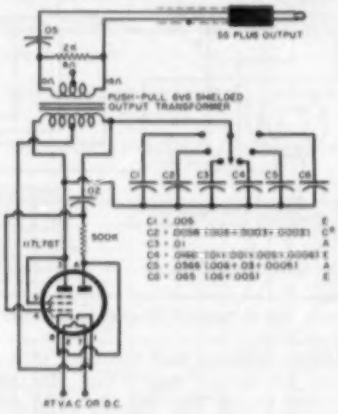
Because the filament voltage and current is simply to heat the cathode, it can be either a.c. or d.c., the voltage depending on the type of tube used.

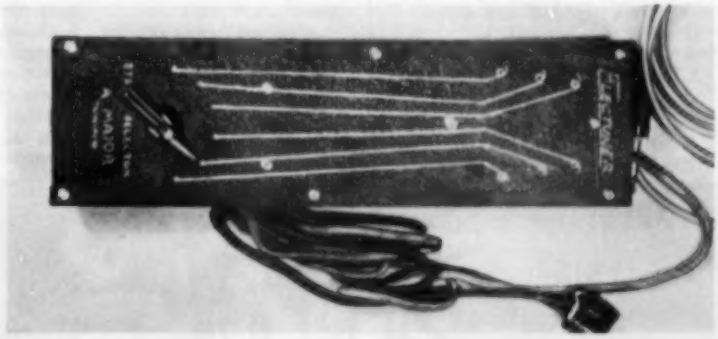


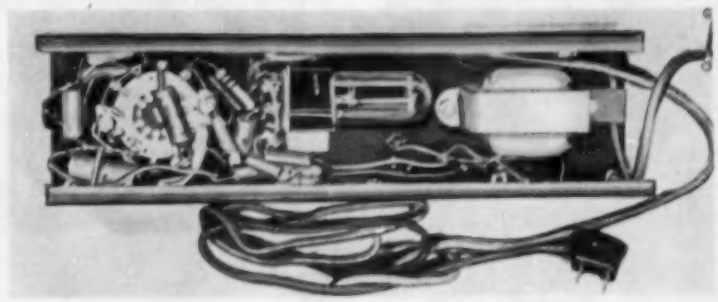
**A simple triode tube is used in this instrument as a basic oscillator. It could take the form of a code practice set or an audio oscillator, to name two uses.**

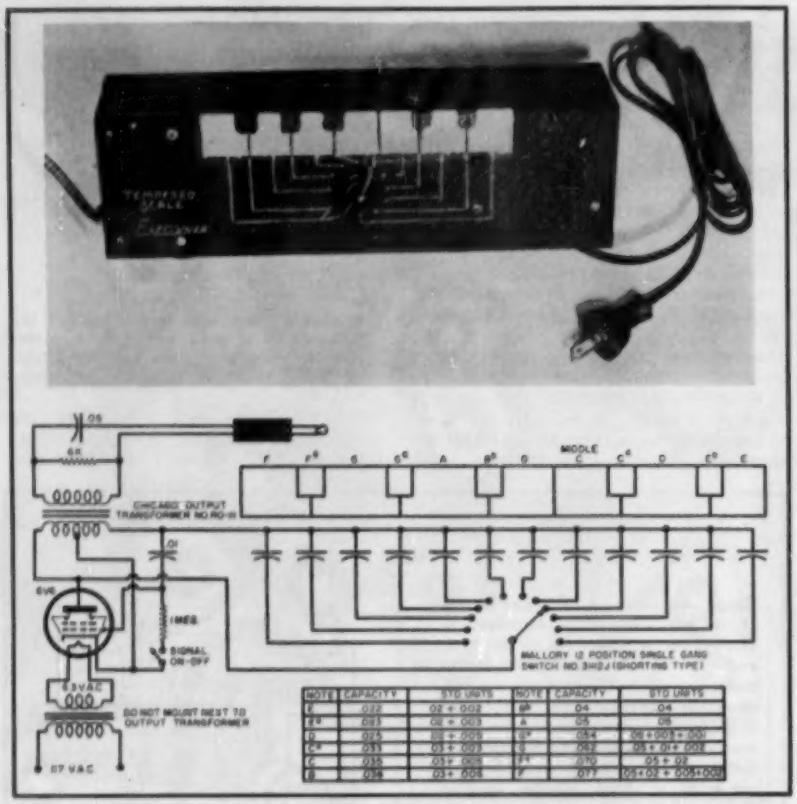
Two schematics of oscillators are shown, one using a 6V6 and the other using a 117L7 which lends itself par-

**Circuit diagram and two photographs of the electronic tuner discussed in this article. It covers six strings in A major tuning. The panel of this instrument, as well as the number and value of the capacitors can be changed to be used as service oscillators, code practice oscillators, signal injectors, and hi-fi test oscillators using a musical scale to check speaker loading placement and other pertinent points.**








| NOTE | CAPACITY | STD UNITS | NOTE | CAPACITY | STD UNITS |
|---|---|---|---|---|---|
| F | .022 | .02 + .002 | $F^{\#}$ | .04 | .04 |
| $F^{\#}$ | .023 | .02 + .003 | A | .05 | .05 |
| G | .025 | .02 + .005 | $B^{b}$ | .054 | .05 + .003 + .001 |
| $G^{\#}$ | .033 | .03 + .003 | B | .062 | .05 + .01 + .002 |
| A | .035 | .03 + .005 | C | .070 | .05 + .02 |
| $B^{b}$ | .044 | .03 + .004 | $C^{\#}$ | .077 | .05 + .02 + .005 + .002 |

**Details on a "piano" 12-note tuner. This circuit can obviously be expanded as desired.**

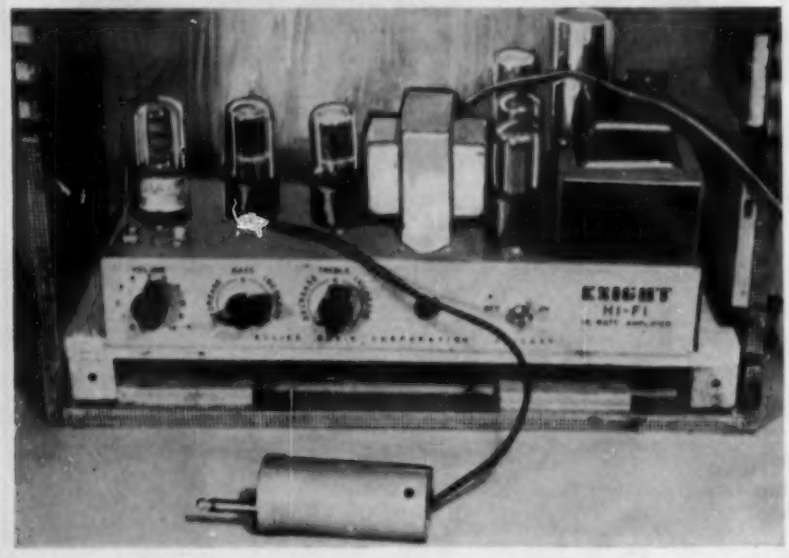
ticularly well to this oscillator circuit since by merely connecting the line current to the filament, our "A" and "B" power supply is wired.

The piano tuner is a tempered octave running from "F" through middle "C" to "E".

The guitar tuner covers six strings in "A" major tuning.

The values of the capacitors shown may have to be trimmed by a very small amount on the high notes due to tolerance changes or differences in commercial transformers. Substitutes using run-of-the-mill capacitors have been made with as many as five random-picked units yet the frequency remains "on the nose" with a standard. These were *Sangamo* units sealed in plastic which seem to hold fairly close.

**A test unit built into a can with plug-power taken from the filament pin on amplifier tube. It can be used as "E" for band work or 400 cycles for test work.**




The panels of these tuners as well as the number and value of the capacitors can be changed, of course, to be used as service oscillators, code oscillators, signal injectors, and hi-fi test oscillators using a musical scale to check speaker loading placement, etc.

It will be noted that the octave tuner can be built for about five times less than the cost of a commercial two-note tuner. It will also be noted that by rotating the rotary switch on the decal keyboard tunes can be played.

The writer has built a monophonic instrument with three octaves of keys using the clickless circuit. It has been in use for a year and is still in tune with the author's *Hammond* with which it is used. It uses one tube, an Alnico magnet vibrato, and produces flute, reed, and horn tones. It can be moved anywhere as it is simply an oscillator in back of a keyboard, and plugged into any amplifier instrument or mike jack. Although this instrument is very simple, it isn't classed as a toy—plugged into a good amplifier system it will perform along with either of the two commercial monophonic instruments on the market. Of course, an added feature is lack of service trouble as nothing ever burns or blows out except the tube.

It is hoped the radio technician, experimenter, and particularly the electronic music and audio man will find new uses for this novel circuit.

Under certain conditions it is very sensitive to changes in the strength of a very weak magnetic field and to minute changes of a d.c. potential. The Seebeck effect (thermoelectric effect) from a soldered joint can stop it. It can be controlled directly from a photovoltaic cell of course, and will be useful in industrial control.

A word of caution, however. Do not expect a tube of low emission or high leakage to work in this circuit. Such tubes can, in ordinary circuits, be used with a high positive potential on the plate and force a few electrons to "work", but remember the electrons leaving by thermal agitation are your "B" supply in this case. A space charge that builds up slowly or a tube with high leakage will produce a signal of the *LC* circuit frequency in small envelope "puffs" of signal.

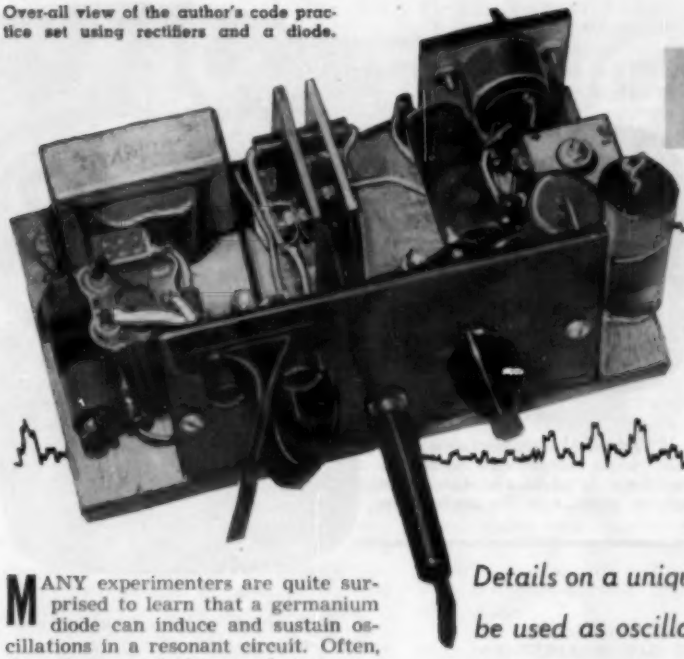
Because this oscillator can be built in a few minutes, many will be constructed of junk box parts—if this is done, the reader should try several of his used tubes for best results.

As a final thought, the author hopes that many experimentally-minded readers will try this circuit since it is fun to build and its applications are numerous enough to offer a real challenge to the builder.

It has the added advantage of being inexpensive—it can be built from the well-stocked junk box or, even purchasing all parts the cost is moderate.

Try it, anyway, you have nothing to lose and you might find this circuit just the sort of thing you have been looking for. —30—

Over-all view of the author's code practice set using rectifiers and a diode.



# GERMANIUM DIODE OSCILLATOR

By IRVING GOTTLIEB

*Details on a unique circuit in which a germanium diode can be used as oscillator for test or code practice applications.*

MANY experimenters are quite surprised to learn that a germanium diode can induce and sustain oscillations in a resonant circuit. Often, there is strong insistence that surgery must be performed to transform the diode into a transistor. The surprise is understandable and the inference is logical; it is nevertheless true that a "garden variety" 1N34 germanium diode can be utilized to generate audio frequencies.

This interesting phenomenon can be quickly divested of mystery by referring to Fig. 1 which depicts the voltage-current relationship of a point contact semiconductor diode such as the 1N34. The portion of the curve shown dotted is not always indicated in the graphs accompanying technical literature. An unusual feature of the curve segment extending from "A" to "B" is that its slope is negative. Another way of visualizing this is to note that a sort of "inverse Ohm's Law" applies over this region; that is, a *decrease* in applied potential coincides with an *increase* in current ("applied potential" here denotes the voltage measured directly across the terminals of the diode). Indeed, a device of this kind is said to display *negative resistance* over such a region of its characteristics.

The vacuum-tube feedback oscillator is sometimes analyzed by postulating that the tube supplies sufficient *negative resistance* to overcome the losses, or "positive" resistance of the *LC* circuit. Theory tells us that an isolated "tank" would naturally be in the oscillatory state except for the omnipresent damping effect of dissipation. Of course, it is true that the energy must initially be stored in either the capacitor or inductance. Thereafter, providing this energy does not suffer attenuation from losses, it surges periodically from one reactive element to the other. The losses include those due to conductor resistance, dielectric leakage, eddy currents, hysteresis, and radiation. All of these together have very much the same effect as a certain value of resistance associated with the resonant circuit and it is just this resistance which must be overcome by *negative resistance*. Better insight into the mechanism of negative resistance can be gained by studying the operation of the "Dynatron" and "Transitron" circuits. In these oscillators, the vacuum tube behaves not merely as an "equivalent" negative resistance, but directly as an element possessing this unique parameter. Also, it should be appreciated that at one time, arc transmitters enjoyed popularity, the electric arc being another means of obtaining negative resistance.

In any event, once we have accepted the notion that inductance plus capacitance plus negative resistance can add up to oscillation, the mere physical form of any of these elements can no longer arouse our suspicion that electronic trickery of some kind must be involved.

The device to be described is intended to be used as a code practice oscillator. It is entirely practical and performs as well as a vacuum-tube oscillator. The idea is not new, but the oscillating abilities of the germanium

(*Continued on page* 106)

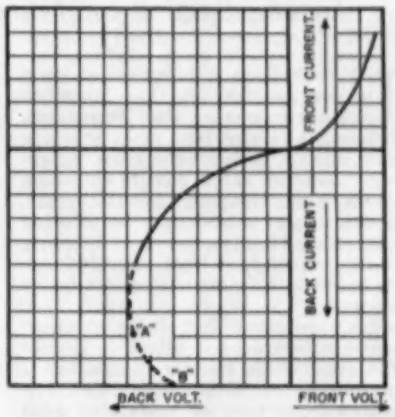
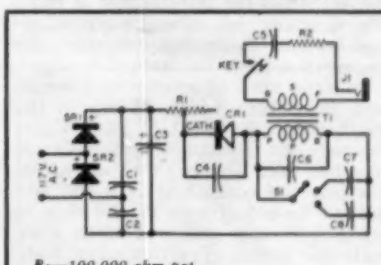



**Fig. 1. Typical voltage-current characteristic of a germanium diode. Note that the slope of the curve in the "A"-"B" region is negative, signifying that the potential drop across the diode decreases as current increases. See discussion in text.**

**Fig. 2. Schematic of the diode oscillator. Constructor should carefully check connections to make certain that components with polarized terminals conform to schematic.**




*$R_1$—100,000 ohm pot*

*$R_1$—10,000 ohm, 1 w. res.*
*$C_1$, $C_2$—.5 μfd., 450 v. capacitor*
*$C_3$—20 μfd., 450 v. elec. capacitor*
*$C_4$—.01 μfd., 400 v. capacitor*
*$C_5$—.001 μfd. mica capacitor*
*$C_6$—.05 μfd., 400 v. capacitor*
*$C_7$—.1 μfd., 400 v. capacitor*
*$C_8$—.25 μfd., 400 v. capacitor*
*$SR_1$, $SR_2$—75 ma., 120 v. selenium rectifier*
*$CR_1$—1N34 germanium diode*
*$S_1$—S.p. 3-pos. rotary switch*
*$J_1$—Phone jack*
*$T_1$—Audio trans. single plate to push-pull grids, c.t. of sec. not used. 1:3 ratio. (Stancor A-73-C, see text)*

# TV SHRINKING PICTURES

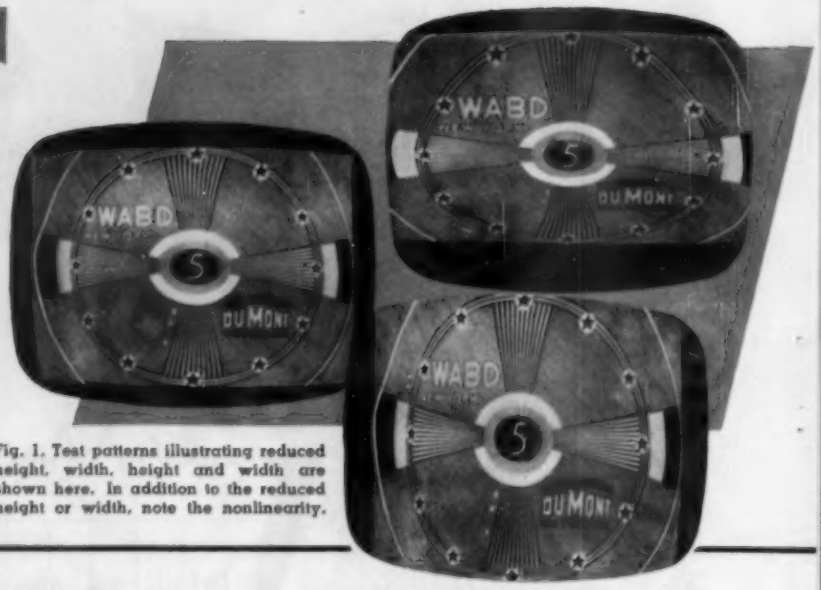



**Fig. 1. Test patterns illustrating reduced height, width, height and width are shown here. In addition to the reduced height or width, note the nonlinearity.**

By **SOL HELLER**

*The causes of decreasing picture size are numerous—knowing them all can help you find the right one fast.*

THE technician is often called upon to service troubles that introduce changes in picture size. Sometimes reductions in size take place that are slow enough to merit the label "creeping." In other cases, picture shrinking develops more rapidly. Width, height, or width and height, may be affected (see Fig. 1). The picture in many cases returns to normal size after periods in which its dimensions are below normal.

Let's consider first those cases in which width alone is affected. One of the commonest sources of trouble is a poor horizontal amplifier tube. Impaired focus may be associated with the loss in width in some receivers. When intermittent shrinking of width is linked with premature failure of the horizontal output tube, a reduction in the cathode resistance of this tube may have taken place. Check the cathode resistor's value, to verify this possibility. Insufficient cathode bias makes the horizontal amplifier largely dependent for its bias on the input sweep signal, resulting in noticeable changes in width in the presence of relatively slight changes in input signal. Insufficient grid drive increases the horizontal amplifier's heat dissipation, and thus shortens its life.

Defects in the damper, horizontal oscillator, horizontal discharge, and low-voltage rectifier tube may possibly cause intermittent changes in width, and should be checked for by suitable tube substitutions.

A drop in line voltage may produce a noticeable decrease in width (without necessarily introducing a visible loss in height). The symptoms are aggravated by the use of inferior or defective horizontal output tubes. Try tubes of different make in this stage of the receiver while the line voltage is low, noting which tube produces maximum width. Availability of an autotransformer with a variable output will permit this test to be made even when the line voltage is normal or above normal. Leave the best tube, *i.e.*, the one with the greatest amount of reserve emission—in the set.

A type of shrinking that rapidly degenerates into a loss of horizontal deflection, and is followed by a total loss of screen illumination, is produced when the grid return resistor of the horizontal output tube opens. A somewhat narrower-than-normal raster tends to appear in this case for a few seconds after the set has been turned on. Horizontal deflection is soon completely lost, with only a vertical line being seen. In the last phase of this rapid sequence, a total blackout occurs.

A relatively slight but noticeable loss in width that develops at intervals may be due to an intermittent open in the cathode bypass capacitor of the horizontal amplifier. Bridging this capacitor when the intermittent is in its active phase, *i.e.*, when width is reduced—will determine whether the source of trouble lies here.

In some cases of intermittent reduction in picture width, arcing in the width coil is responsible. This is particularly apt to occur when the core or slug has been screwed all the way in, bringing the core close to a coil terminal. Re-adjustment of the slug to bring it farther out will often eliminate the arcing. Try this when audible or other signs of arcing in the coil are noted, or when the coil has become suspect by a process of elimination.

An unusual source of trouble sometimes turns up in the *Capehart* CX-33 chassis. The symptom produced is an approximately ⅛ decrease in picture width during the first quarter hour after the set is turned on, followed by a gradual restoration of width to normal during the next hour. The trouble is due to a defect in the isolating transformer used in the damper heater circuit. Early-model units had not been properly baked, and had excessive capacitance between their windings as well. Although an obscure trouble of this type is not likely to be encountered by the technician, its occurrence is possible; a heater circuit defect of this kind should not, therefore, be automatically exempted from suspicion when changes in width are the complaint.

## Vertical Shrinking

Shrinking of the picture in a vertical direction not infrequently takes place. The picture may be normal in size when the receiver is first turned on, then may fall off in height, generally at the bottom. The loss in height may be anywhere from ½ inch to 2 inches or thereabouts.

The fault may lie in a weak vertical output or oscillator tube. Also, the low-voltage rectifier's emission may have decreased; or perhaps some other fault in the supply has reduced the "B" voltages, and thus made the receiver more susceptible to a falling off in efficiency of a vertical tube, or a reduction in line voltage.

When the output of the damper feeds the vertical as well as the horizontal amplifier, a loss in the emission of the damper or horizontal amplifier —or of any horizontal circuit tube for that matter—will cause reduced voltage to be applied to the vertical amplifier, causing its output to fall off, and

height to be reduced. Measure the damper cathode-to-ground voltage, or substitute horizontal circuit tubes, to check on this possibility.

The slow development of grid emission in any tube may cause a gradual overloading of one or more other tubes, and impose an excessive drain on the low-voltage rectifier as well. The supply voltage to the vertical amplifier may be reduced to the point where height is affected, as a result. Chances are additional stages will be affected as well, producing other symptoms besides a height reduction. "B" voltage and bias checks will help localize this source of trouble.

An insufficiently-advanced horizontal drive setting may (in cases where the vertical amplifier is fed from the "B+" boost line) be a contributing cause of a loss in height. Vertical reserve size may be reduced to the point where a drop in line voltage, or some other source of lowered efficiency, causes an appreciable loss in height. Advance the horizontal drive setting to the point where overdrive lines just become visible, then reduce the setting slightly, until these lines are invisible again, to be certain that the setting of this control is correct.

Intermittent leakage in the coupling capacitor between the vertical oscillator and amplifier may be responsible for intermittent vertical shrinkage. Check the grid-to-ground voltage of the vertical amplifier when the intermittent is in its active phase, to determine whether this fault is present. A d.c. voltage of less than .2 volt should be measured, if the grid is returned to ground. The vertical oscillator tube is removed from its socket or otherwise disabled for this test. If the d.c. voltage measured is larger than .2 volt, remove the vertical amplifier tube (unless a series-heater setup is present) and recheck the voltage. If the excessive voltage is still present, a new capacitor (preferably a molded type) should be substituted, and results noted. Several capacitors may have to be tried to obtain one with acceptably low leakage. (Appreciable leakage in the coupling capacitor will generally cause a bright horizontal line to appear at the bottom of the raster.)

If low line voltage is the cause of vertical shrinking, and a 6SN7 is used in the set as a vertical amplifier, try substituting a 6BL7GT in its place. It should be kept in mind, however, that some 6BL7GT tubes are notorious sources of grid emission—a fault that can introduce vertical distortion as well as shrinking.

When the raster's height decreases after being normal for some hours, and the amount of shrinking is small, height and linearity controls may be adjusted to produce a slight amount of overscan, possibly ⅝-inch or thereabouts. Subsequent shrinking will no longer be visible if this is done.

When a lack of reserve height seems to be responsible for a relatively slight amount of shrinking, try increasing the vertical oscillator output by using a smaller value of resistance ($R_{113}$, Fig 2) in the vertical oscillator discharge circuit; or decrease the size of $C_{107}$. Too great a reduction in $R_{113}$ or $C_{107}$ will, of course, introduce appreciable non-linearity into the vertical sweep, and should be avoided.

When even a slight reduction in the charge-discharge capacitor or resistor introduces too much nonlinearity, try increasing the value of grid resistance in the vertical amplifier ($R_{115}$, Fig. 2) up to a maximum of one-third more, to boost the vertical amplifier output. Keep in mind, though, that too much of an increase may promote grid emission. Keep the set operating, preferably in its cabinet, for about two hours after such a change, to make sure that emission effects (causing a positive grid and vertical distortion) are not present.

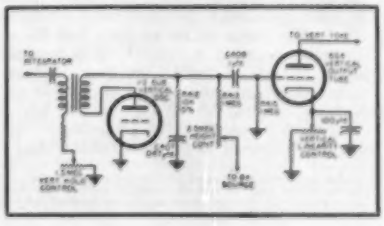
An early-type vertical yoke may be responsible for a lack of reserve height, predisposing the raster to vertical shrinkage. A later, more efficient model using an iron core may have to be substituted, if other remedies prove inadequate.

Vertical shrinking may be due to a change in characteristics of the vertical output transformer. Heat is apt to cause such an undesired change, when certain defects in the transformer are present. Substitution of a new transformer will serve as a test for this defect. It is assumed that a loss in output has been traced to the vertical amplifier, and no other component defect in this circuit is evident.

An intermittent decrease in vertical size is not infrequently due to a defective capacitor in the "B+" boost circuit (when the vertical amplifier is fed from the "B+" boost line). These capacitors are exposed to relatively large voltages and are therefore particularly apt to develop intermittent (or permanent) defects. In the case of *Du Mont* RA 306/307 receivers, an intermittent leak in $C_{306}$ (see Fig. 3), the 10 μfd., 350 volt semipolarized "B+" boost capacitor, will produce, intermittently, a rather low buzz in the sound, as well as a decrease in picture size.

An intermittent open in the coupling capacitor between the vertical oscillator and amplifier can be the cause of intermittent shrinkage of height. Try wiggling this unit with a pair of long-nose pliers; if shrinkage is introduced during this test, and disappears when the unit is bridged with an equivalent capacitor, the coupler is bad.

**Fig. 2. Vertical sweep circuit used in the Admiral 19B1 chassis. This is a typical vertical sweep circuit for TV sets.**



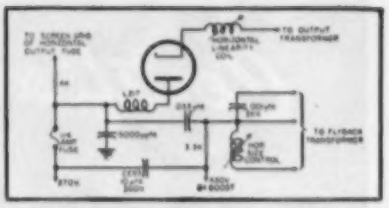


**Fig. 3. Damper and boost "B+" circuit used in the Du Mont RA-306/307 chassis.**

## Over-all Reduction

When both vertical and horizontal size are reduced during receiver operation, a loss of emission may be taking place in a low-voltage rectifier. This is particularly likely if proper focusing is obtained or approached only when the focus control is placed at one extreme of its range; or if contrast, sync, brightness, or synchronization (as well as size) has been affected. Replacement of the rectifier will serve to check on this possibility.

Many cases of loss in size are due to a drop in line voltage. Such a drop, especially when it is abetted by a loss of efficiency in a sweep or low-voltage rectifier stage, will cause vertical and/or horizontal shrinking. Brightness, contrast, sync, sound, or focusing may be noticeably affected as well; on the other hand, such associated effects may not be evident. If a strong signal is coming in, for instance, a reduction in line voltage may not affect contrast appreciably, even though the sweep circuit output is noticeably reduced.

Line voltage in residential areas is generally higher in the morning and afternoon than it is in the evening, when power demands on the lines are greater. If the shrinking in size occurs in the evening, chances are a line voltage drop is the cause; a check of the voltage should be made at the customer's home in the evening, to verify whether the source of trouble lies here.

An easy—but relatively expensive—way to eliminate such troubles is by using a step-up or constant-voltage transformer. Other methods involve boosting the reserve sweep of the receiver in one of various ways. Some makes of sweep tube can deliver more current in the presence of reduced line voltage than others can. This is particularly true of tubes used in horizontal output stages. It is therefore advisable to try other makes of tubes, and several samplings of the same make, to find a sweep tube capable of providing proper height or width, as the case may be. Some means of reducing the line voltage at the shop should be available, if the test is made there. The tube substitutions may, of course, be made in the customer's home at the time that the reduced line voltage has decreased the raster's size.

In some cases, a more efficient type of rectifier may be substituted for the one present, to maintain the "B" voltage at a higher level when the line voltage falls. A 5V4G, for instance, may be substituted for a 5Y3G. If the

(*Continued on page* 104)




By **BERT WHYTE**

THE record industry is still fussin' and fumin' about the price reductions. Some companies are determined to keep their product pegged at the original prices, others have gone down in price only to go back up again in a few weeks, and as for the rest . . . no one seems to know, "who's on third," or anything else! Well, we've spent enough space in comment on this situation. If any big trend develops, I will try to get "on the inside" and report anything significant to you.

Things must run in cycles in this hi-fi world. Some months, all the letters I get are from people complaining about record surfaces; other months, it seems everybody is having trouble with their crossover networks, etc., etc. This past month seems to belong to the audiophiles with phono-cartridge troubles. Now admittedly, there are plenty of things that can go wrong with a pickup. But gosh-amighty, some of you folks are just aidin' and abettin' trouble! At best a pickup cartridge is not the most rugged of devices. Sure, diamonds are mighty hard and wear at a slower rate than any other type of stylus material. But they are also *brittle*, and a few hard knocks on the diamond may cause a ruinous crack. The average hi-fi fan is slightly fanatic (or should be) when it comes to keeping his records and equipment clean. But this can be carried too far, with some very disastrous results. For instance, I am in receipt of several very sad letters from some folks who in the course of cleaning dirt from their styli, inadvertently brushed away the silica-gel damping material which is a necessary part of certain cartridges. These well-meaning people were complaining that their cartridges "didn't sound right." I shouldn't wonder, since an undamped stylus can give rise to incredible amounts of distortion, as much as 25 per-cent! The damping material is particularly important in the *Pickering* cartridges. In fact, to assure continuous optimum performance, the *Pickering* factory suggests that these units be returned to the factory once a year for examination. This is a good practice as they will not only make sure the damping material is up to snuff, but examine the stylus for possible signs of wear and inform you if replacement is indicated. This silica-gel damping material is a whitish waxy-looking substance and may be quite firm, or soft and freely movable. Don't touch it! In many instances the damage is done by inquisitive hi-finatics opening up the cartridge cases just to see "what makes it tick." In most pickup units the damping material is well protected *within* the case and normally would not be subject to tampering. *Don't open your cartridge cases!* Not only may damage result, but most companies have a policy of voiding their warranties if there is evidence of customer "diddling." When you do clean your stylus of dust, etc., avoid the practice of "flicking" the stylus with your finger. This "flicking" is one of the best ways to displace the silica-gel. It is also wise to avoid "blowing" the dust from the stylus as your moisture-laden breath may find lodging in some delicate parts and cause corrosion. The best thing is to use a soft camel or sable hair brush, and gently clean around the stylus. One last admonition; if your cartridge is used in "plug-in" fashion, when not in use *do not place it near any source of heat*, such as preamplifier, etc. The silica-gel is not very stable at high temperatures and you might have a little trouble.

Equipment used this month: *Pickering* 260 cartridge and 190B arm, *Components Corporation* turntable, *Marantz* audio consolette, two *McIntosh* 30-watt amplifiers, *Jim Lansing*, 34001 horn speaker system, *Electro-Voice* "Georgian." Tape equipment: *Ampex* 600.

### *MAHLER*
### SYMPHONY #1 ("TITAN")

**Vienna Philharmonic Orchestra conducted by Rafael Kubelik. London LL1107. RIAA curve. Price $3.98.**

**New York Philharmonic Symphony conducted by Bruno Walter. Columbia SL218. Old NARTB curve. Price $5.95.**

The sixth and seventh versions of Mahler's most "popular" symphony and superior to all that have preceded them, both sonically and performance-wise. I was particularly pleased to find Rafael Kubelik recording with the *London* label. After his splendid recording tenure with *Mercury*, I was hoping he would go with an organization capable of affording him the high quality sound to which he had become accustomed, and which his talent most certainly merits. *London* is, of course, well qualified for this task. This Mahler 1st is to be followed by all the other Mahler symphonies, with Kubelik at the conductorial helm. An ambitious project that will be good news to avid "Mahlerites." Making a choice between these two versions is not an easy job. Bruno Walter is an unquestioned authority on Mahler and to be sure, his reading is magnificent. His tempi are just, his balance impeccable, and his phrasing deft and sure. But more than all of that is his "warm" interpretation. Dr. Walter makes the work "sing" with an easy naturalness . . . no forcing or storming here. It does not lack strength or vigor, however. The impression is that there are sinewy muscles under the velvet glove. Kubelik approaches the score more obliquely. His feeling seems to be as deep, but his expression somewhat restrained. It is best perhaps, to call Kubelik's reading "earthy," rather than romantic. But judicious or not, Kubelik outguns Dr. Walter in the famous "sturmisch bewegt," the last movement. The finale is supposed to be "triumphant" and in Kubelik's hands it certainly sounds that way! The trumpets and the famous French horns (seven of them!) blare forth in all their glory. Of course, this superiority is in large measure due to the splendid sound of the *London* disc.

The Walter is typical "good" *Columbia* sound, but not one of their outstanding jobs. Dynamics seem cramped, and the bass line is somewhat thick-textured. Dynamic range is one of the most outstanding features of the *London*, along with generally clean string tone, richly resonant brass, and the superbly "live" Vienna Philharmonic woodwinds. While the *London* disc is characterized by wide frequency response, there are some sections (notably in the climaxes), where the sound is surprisingly "coarse," and is not at all typical of their best efforts. Everything considered, however, this is the best-sounding Mahler 1st in the catalogue. You might sum up these two discs this way; The Walter will appeal to those who place performance above all other considerations, and the Kubelik will find sympathetic ears from those who want a reasonably good performance and insist on the best sound. Both discs conformed to their curves and both had moderately quiet surfaces.

### *STRAUSS, JOHANN*
### WIENER BLUT

**Philharmonia Orchestra and Chorus conducted by Otto Ackermann with Elizabeth Schwarzkopf, Nicolai Gedda, Erich Kunz, Erika Keth, Emmy Loose, Karl Donch, and Alois Pernerstorfer, soloists. Angel 13519 (3s). RIAA curve. Price $9.96. Two discs.**

If you are a lover of "Die Fledermaus," or the "Merry Widow," or for that matter practically anything Straussian . . . this is your meat. Cast in the same mold as those earlier works, it is in reality a collection of many songs and settings that Strauss had composed over the years and which were compiled and collated to form "Wiener Blut." Hodge-podge though this might seem, and although Strauss never lived to hear the production it has nonetheless become a beloved favorite the world over. This is a first-rate job on all counts. Schwarzkopf is in her element in this sort of thing and she is completely captivating as Gabriele Gedda is his usual good self, and it was a pleasure to hear Emmy Loose sing so well after such a long absence from records. The rest of the cast seems quite competent, and the conducting of Ackermann, exemplary. His hand is always light and the whole production fairly bubbles with "Gemutlichkeit." Sound is in the best *Angel* tradition which means suave smooth strings, rich brass and woodwinds, nice "live" acoustics. Choral and orchestral work was of very high order, with good balance and dynamics. It would be a real curmudgeon who could resist the blandishments of this charming work. Highly recommended. Curve and surfaces OK.

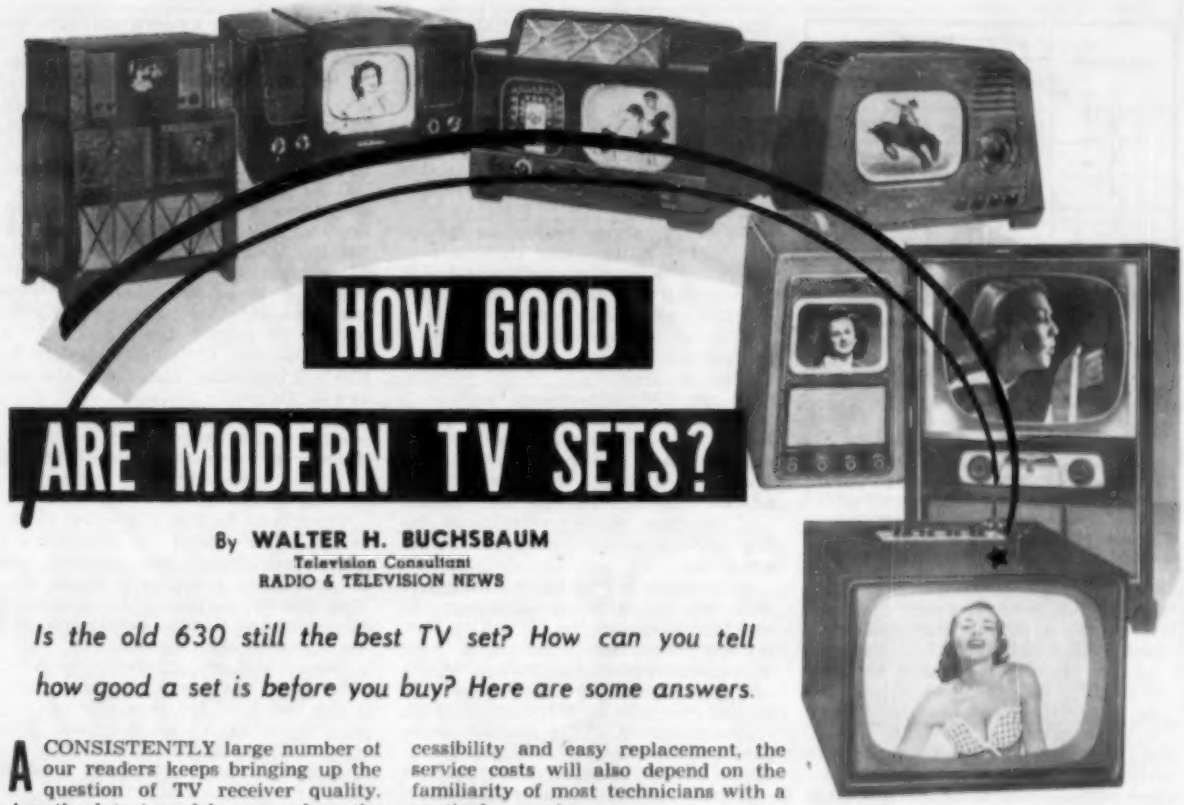
### ORGAN MUSIC OF THE 17TH CENTURY

**Gustav Leonhardt, organist. Vanguard-Bach Guild BG529. Old NARTB curve. Price $4.98.**

You lovers of the baroque in organs and organ music will find this a particularly satisfying disc. Works by such stalwarts as Praetorius, Frescobaldi, and Scherer and other less well-known baroque composers are splendidly performed by Gustav Leonhardt on the magnificent old organ of the Stiftskirche at Klosterneuberg, Austria. Built in 1636-1642, the clear, clean intonation and typical baroque "hoarseness" and "breathiness" of the stops, especially the reeds, is reproduced with startling fidelity. Purists will perceive that the instrument is pitched one half tone above our normal pitch. No big pedals here for you

(*Continued on page 95*)

The opinions expressed in this column are those of the reviewer and do not necessarily reflect the views or opinions of the editors or the publisher of this magazine.



# HOW GOOD ARE MODERN TV SETS?

By **WALTER H. BUCHSBAUM**
Television Consultant
RADIO & TELEVISION NEWS

*Is the old 630 still the best TV set? How can you tell how good a set is before you buy? Here are some answers.*

A CONSISTENTLY large number of our readers keeps bringing up the question of TV receiver quality. Are the latest models as good as the old 630-type sets, how does brand "A" compare with brand "B," can fringe reception be as good with a standard model as with a custom-built receiver? Many of our readers have been asked these questions themselves by their customers and friends. Actually, some standards are available to serve as a guide for comparing receiver performances.

Before going into the merits of the various circuits, consider the criteria by which receiver quality can be judged. Certainly price is an important factor. No one expects the same performance from a *Plymouth* as from a *Cadillac* and the same holds true for TV receivers.

In weak signal areas, the sensitivity of the receiver is a vital performance criterion while in metropolitan locations, even poor sensitivity produces good pictures. The quality of the picture depends on such design features as bandpass, noise immunity and sync circuits, and the picture tube itself. With the advent of high fidelity, the sound reproduction capabilities of a TV set are also often important considerations.

As far as troublefree operation is concerned, there is absolutely no way, irrespective of cost or design features, to guarantee undisturbed operation of any electronic device. The set manufacturer who uses only well-tried circuits, reliable components, and careful test and quality control procedures will undoubtedly earn a better reputation. Aside from such features as accessibility and easy replacement, the service costs will also depend on the familiarity of most technicians with a particular receiver.

Summing up these criteria we can see that from a technical point of view the following features should be considered in comparing TV receivers: 1, picture quality (bandwidth, picture tube, freedom from interference, etc.); 2, sensitivity; 3, circuit reliability; 4, quality of components; 5, serviceability; 6, sound reproduction; and 7, u.h.f. reception.

If we are to compare older sets, about 4 to 5 years old, with the latest receivers, it is obvious that the new models win hands down on such items as picture tubes, high voltage and linearity, and serviceability. The score is not so clear cut when it comes to good bandwidth, good sensitivity, and quality components.

### Is the 630 Still Best?

This question is often debated among service technicians. It is true that some manufacturers specializing in custom-type sets have modified the 630 circuit to incorporate all of the latest advantages of better picture tubes, circuits, and components. These versions are naturally very high quality sets since they have retained the best features of the original design and have added only those new wrinkles that really improve the set. Most important however, is the fact that these sets are built usually with the original 630 philosophy in mind—cost was secondary and only performance and reliability counted. With the cost of TV sets as low as they are today, this type of thinking is not very practical except for the limited, luxury-type market.

The original 630 receiver had many features which would be severely criticized in today's models. Aside from the small picture tube, the tuner, for example, did not stand up for very long. Some companies practically started in business just replacing the detents of the KRK-2 switch tuner in the original 630. Nostalgic TV viewers also forget the many service calls due to misadjusted front panel controls, especially the horizontal hold control. Lack of a.g.c. was another feature of the 630 which is often forgotten. As for ease of servicing, it is fortunate that today's 21-inch chassis do not weigh as much in comparison as the 10-inch 630 did. Did you ever try replacing the vertical output tube in the 630 with the chassis in the original cabinet? How about the high-voltage compartment?

Actually, the 630 circuit was quite appropriate for its time and served as a basis for future development, but there was no magic in it. Sound design, clean chassis layout, and reliable components are just as available today as in the "good old days."

One of the great advances in TV has been in picture tube development. Together with this, the deflection circuitry has been simplified and improved. As an example, compare the two circuits in Fig. 1. Fig. 1A is the circuit used in the original 630. Six and one-half tubes are used for this horizontal sync, flyback, high-voltage section. Of these tubes, only the 6BG6

| CHANNEL | NOISE | |
|---|---|---|
| | 630 | 21-S-500U |
| 2 | 14 db | 4 db |
| 3 | 15 db | 4 db |
| 4 | 13 db | 5 db |
| 5 | 14 db | 4.5 db |
| 6 | 16 db | 6 db |
| 7 | 18 db | 8 db |
| 8 | 18 db | 8.5 db |
| 9 | 17.5 db | 8 db |
| 10 | 18 db | 7 db |
| 11 | 19 db | 8 db |
| 12 | 19 db | 8.5 db |
| 13 | 19 db | 8.5 db |

**Table 1. Comparison of the tuner noise figures of the original 630 TV set and of a typical cascode-amplifier tuner.**

and the 1B3 were specially designed for TV, while the others were previously-used types from radar and radio receiver applications.

In Fig. 1B, only four tubes are used and only the 6SN7 is not a special TV-type tube. Other receivers use special TV tubes exclusively in this circuit. The important thing, however, in comparing circuits is performance under all conditions, and in this respect, the circuit of Fig. 1B is superior in many ways.

First, there is only one control for horizontal frequency—a secondary control which the customer hardly ever needs to touch. The stabilizing coil in the horizontal oscillator circuit makes the unit more immune to sudden disturbances such as noise or line voltage surges. Second, because the entire section is more efficient, it requires much less d.c. power and therefore generates less heat. This helps all components to last longer. Third, the 6AX4 damper diode does not require a special heater winding, as did the 5V4, and is also more rugged.

As every service technician knows, the flyback transformer itself is now much smaller and more efficient due to the use of ferrite or similar cores. Last, but not least, the deflection yoke is of the cosine type which provides uniform focus and linear deflection over the entire screen area.

In the 630 high-voltage section, a large amount of power was dissipated in the 6300-ohm linearity-adjustment resistor. The width-control coil and the linearity-control coil were both hard to adjust without removing the chassis, and the fuse replacement inside the high-voltage chassis was often quite annoying.

Leaving the horizontal-deflection section, we can also see advancements and innovations in the i.f. section that brought improved performance. One of the improvements in modern receivers is, of course, the use of a.g.c. to control the gain of the tuner and i.f. stages, resulting in the elimination of overloading under strong signal conditions. Another feature of the modern i.f. circuit is that it frequently consists of a printed-wiring subassembly and uses the new i.f. of 41 to 46 mc. Improved tubes provide more gain-per-stage than did the 6AG5 used in the older 630.

An actual comparison of the two i.f. systems shows substantially the same gain (although modern circuits use only three tubes to the 630's four), a very slight deterioration in i.f. bandwidth, and much greater stability of the new circuit. The reduction in i.f. bandwidth is in the order of 0.2 mc., which is made up by the video peaking circuit in the video amplifier section.

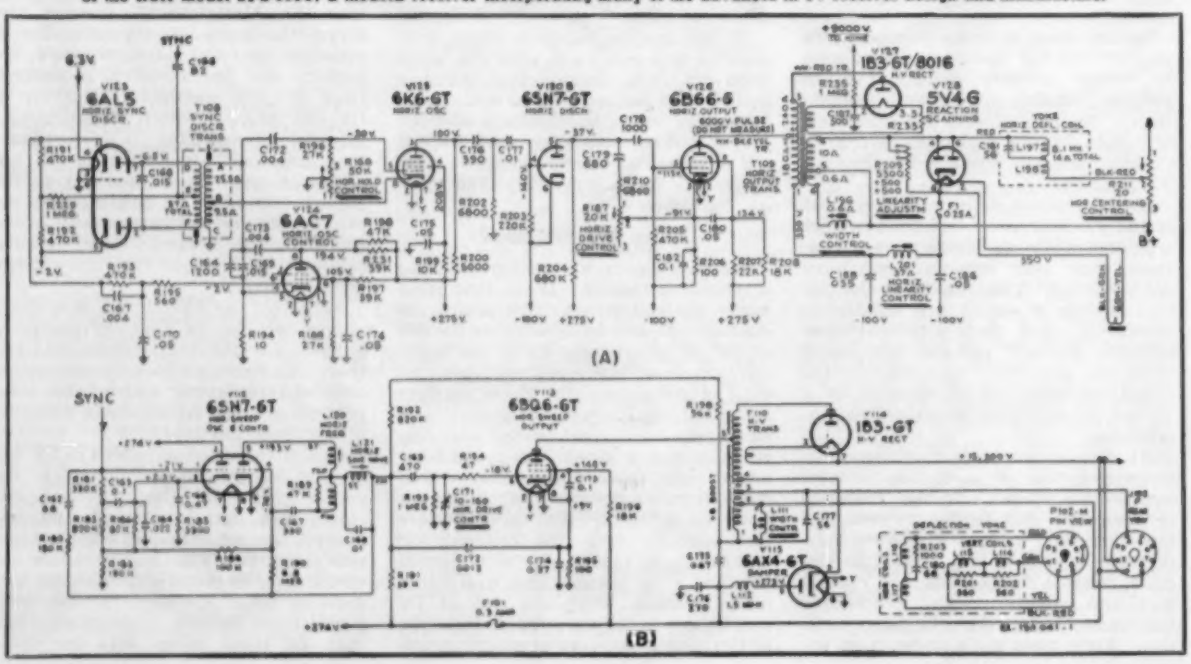
The observant reader will notice that there is only one trap in the modern circuit of Fig. 2; the original 630 had five. One reason for this is the use of intercarrier sound, allowing the sound i.f. to be amplified along with the video. Another factor reducing the number of traps is the higher "Q" of the individual i.f. coils as indicated by the lack of loading resistors in the last two i.f. stages.

Since the new i.f. is 41 mc., the bandwidth required, approximately 3.5 mc., is easier to obtain than with a 21 mc. i.f., for the bandwidth is a smaller percentage of the i.f.

The circuit in Fig. 2 is novel in the use of bifilar-wound i.f. transformers which have almost unity coupling and can be tuned just like a single coil. This greatly simplifies the alignment procedure and thereby greatly reduces the chance of misalignment.

One important difference between the old 630 and new high quality sets is the fact that the new sets can receive fringe signals much better. This is due in part to the use of a cascode r.f. stage in the tuner giving a much better noise figure and therefore less "snow." Also, some kind of delayed a.g.c. bias is often provided, which gives maximum sensitivity of very weak signals. The sync separator sections of most quality sets contain noise immunity circuits which help stabilize the picture against noise interference.

**Fig. 1. (A) The horizontal sweep and high voltage circuits of the original 630 TV receiver. (B) Corresponding circuits of the RCA model 21-S-500U, a modern receiver incorporating many of the advances in TV receiver design and manufacture.**



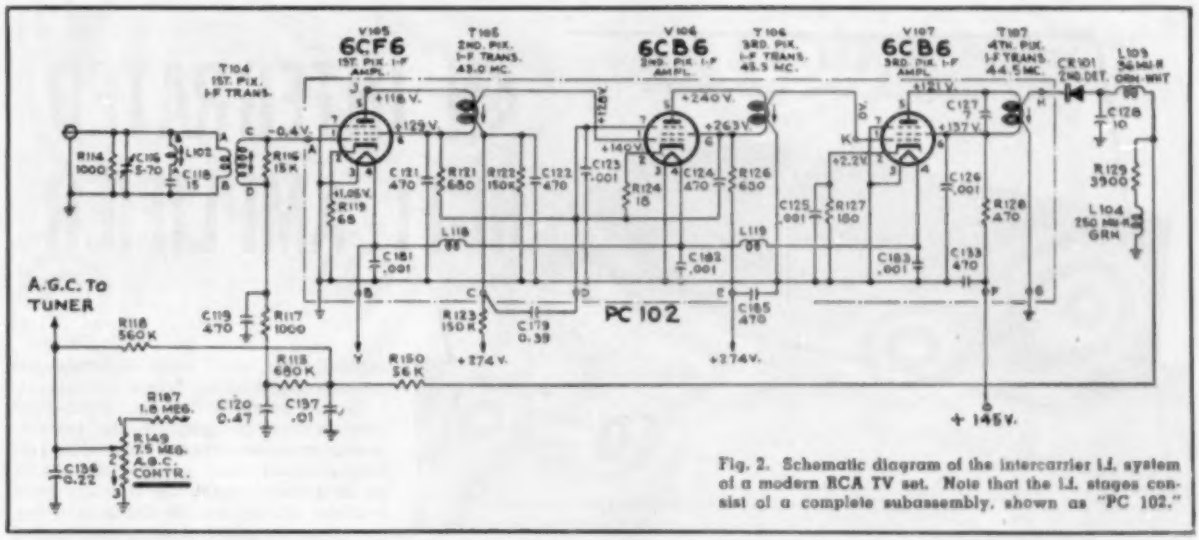



Fig. 2. Schematic diagram of the intercarrier i.f. system of a modern RCA TV set. Note that the i.f. stages consist of a complete subassembly, shown as "PC 102."

Many of these features are found in the custom-type 630 sets now being offered, but were not part of the original model. As a means of comparison of set performance, Table 1 and Figs. 3 and 4 show typical tuner noise figures, i.f. response curves, and over-all response curves of the old 630 and a typical production sample of the *RCA* 21-S-500U. On all counts, the new set is is either equal to or better than its ancestor.

One very interesting thought pertinent to this discussion of the merits of the new simplified receivers is the role this simplification has played in the development of color television. There is no doubt that one of the important factors in whether color sets will sell is their cost, and one of the important items in the cost of the set is the cost of the monochrome and sound sections. Simplified circuitry has reduced this cost materially.

## Selecting a TV Set

Individual needs and tests should determine the choice of receiver rather than any rigid technical data we can set down. There is one important consideration which sharply divides all TV sets into two groups and that is fringe reception. Even if five channels come in strong in a particular location, if one is weak the area is practically a fringe location and a fringe-type receiver should be selected.

For the service technician, it is a simple matter to look at a receiver schematic and decide if a set is suitable for fringe reception. He will look at the tuner input to make sure a cascode circuit is used. Next, he will look for a "fringe-local" switch and see if this really increases sensitivity. Another criterion, especially in a noisy location, will be the presence of noise immunity circuits.

There are some general rules which most of the popular brand manufacturers follow and which give an outward indication as to the capabilities of a set. The more sensitive receivers usually have provision for u.h.f. and a "fringe-local" switch or some adjustment for varying the a.g.c. operation.

TV sets without a power transformer are usually not intended for fringe operation. A good example of such an economy receiver is the *CBS-Columbia* Model 1601, whose block diagram is shown in Fig. 5. Only 15 tubes are used in the entire set including the picture tube. Series heater tubes are used with a transformerless power supply. Although this set has a three-position switch for different signal levels, only the tuner a.g.c. is varied here and not too much benefit is derived from this feature. This receiver will give excellent pictures in local and near-fringe areas.

After determining whether a fringe or local set is needed, the next consideration will concern the picture size and cabinet type. Most manufacturers make two series of chassis and often both are available in similar cabinets. That is why the layman is often puzzled by the fact that he is offered two different 21-inch sets, of similar cabinetry, but with different prices. The higher priced one invariably has the fringe area feature.

Once the picture size and cabinet style is settled, the profusion of many different brands with only slight price variations still confuse the customer. Here we must tread carefully in advising any particular brand. It has been our experience that the exact price of a set is not an indication of its true comparative value. A set ten dollars cheaper is not necessarily worse, nor need it be better just because it has been widely advertised. The final choice should depend on the availability of competent local service for a particular set, special features such as better sound or better cabinetry, and the reputation of the manufacturer and his local dealer. A small price difference can easily be overcome by better service, for example, over the course of a single year.

Choosing a TV set is pretty much like choosing a car or a girl friend. It is not only the appearance that counts, nor the way it works when on demonstration, but many different factors must be evaluated and step-by-step the choice is narrowed down. —30—

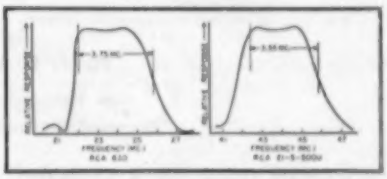


Fig. 3. Comparison of the i.f. bandwidths of the 630 and a modern set.

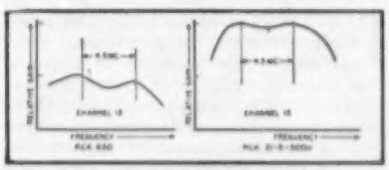
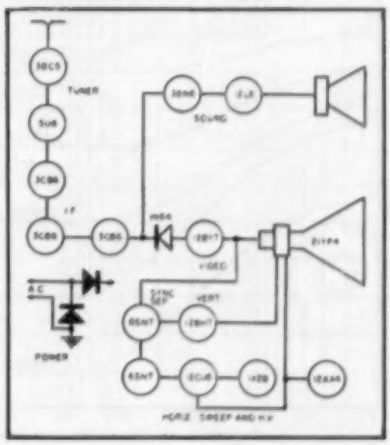


Fig. 4. Comparison of the over-all response at a high channel of the 630 and one of its modern counterparts.

Fig. 5. Block diagram of a new CBS-Columbia economy-model TV receiver.



# AN INTEGRATED HI-FI AMPLIFIER



Front view of the Model S-1000 amplifier-preamp-control system unit by Sherwood.

By
**EDW. S. MILLER**
Gen. Mgr. and Chief Engr.
Sherwood Electronic Laboratories

*Design data on a compact unit combining a control unit, preamplifier, and power amplifier in a single housing.*

IN RECENT months more and more designers have been turning their talents to the problem of meeting the demand represented by the general market. As a result, several amplifiers have been developed which combine both a phono preamplifier and control system in an integrated, self-cabineted unit.

The unit to be described, the *Sherwood* Model S-1000, provides these features plus a complete group of operating refinements which the less technically minded music lover will appreciate.

Recent tests by large consumer organizations and experts show that under typical home-listening conditions, essentially no difference can be discerned among different brands of *good* basic high-fidelity power amplifiers (except in cases where the amplifiers affected speaker operation because of variations in damping).

On the other hand, the same studies showed that differences *can* be heard among most tone-control designs and other controls which affect frequency response in some way. In addition, annoyances such as switch clicks, hum, rumble, hiss, etc., were objectionable to even the most untrained listener.

Guided by these findings, the S-1000 amplifier was designed to meet the following requirements: (1) low noise and hum level at least as good as that of an amplifier employing d.c. operated heaters; (2) no switch clicks or other disturbances accompanying any control operation whatsoever; (3) accurate push-button-operated record equalizer selector; (4) cathode-follower recording output preceding the tone controls and the loudness control. Provisions must be made to eliminate possible recorder feedback when playing back from the recorder; (5) calibrated tone controls having accurate flat settings and low distortion, especially at the intermediate settings of the treble control where conventional controls exhibit frequency response curves with a shelf-like shape; (6) a loudness control that operates without compensation at a centered or "12 o'clock" setting and thus provides a reserve of flat gain; (7) a front-panel switch to remove loudness compensation and restore conventional flat volume control action with no change in level; (8) a speaker damping switch to provide a choice of high or low and, especially, negative damping; (9) front-panel operated rumble and scratch filters with 12 db./octave frequency slopes; and (10) a good basic 20-watt amplifier which has

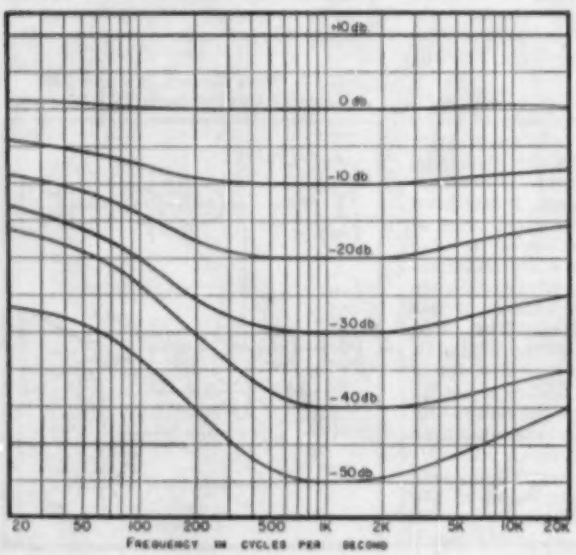
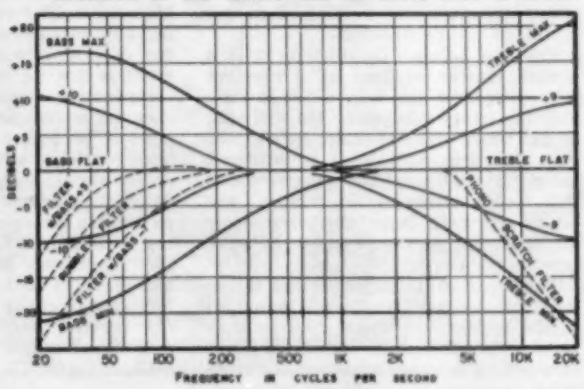



**Fig. 1. Compensation curves obtained with the Centralab Model A control incorporated in the Sherwood Model S-1000 amplifier. Special taps at 18 and 40 per-cent rotation introduce loudness compensation at a more counterclockwise position. See text.**

**Fig. 2. How the bass control's characteristics combine with the rumble filter's characteristic to give varying frequency turnovers to the sharp low-frequency filtering. For a full discussion of this feature and its effect, refer to article.**



less than 1½% intermodulation distortion at 15 watts. (The frequency response at this level must be flat from 30 cps to 15 kc.).

The circuit that evolved is shown in Fig. 3.

A feedback, bypassed-cathode type phono preamplifier circuit is used with the low-noise, low-microphonic British Z729 input tube. Record compensation is simplified for the music lover by the use of a four-button push type switch. Each button gives exact equalization to 30 cps for LP, RIAA (new AES), London, or European recordings.

By careful heater layout, hum is kept below a —60 db or 1½ μv. level (at input grid). This is equivalent to results obtained with d.c. operated heaters.

A s.p.d.t. switch, in conjunction with $C_m$ and $R_m$ (across the phono input), is used as a scratch filter with magnetic cartridges. This circuit has a 12 db per octave roll-off and a 5 kc. turnover when used with a *G-E* pickup.

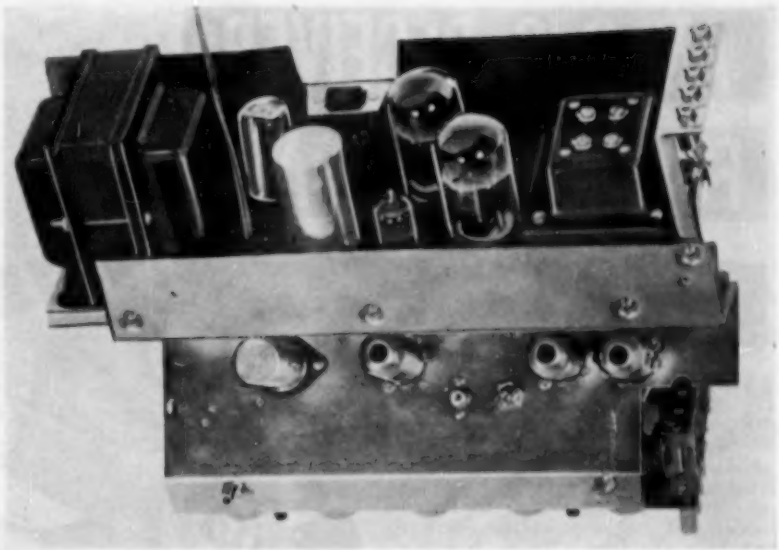
To avoid the possibility of overloading a recorder by improper tone control adjustment, the recorder output in the circuit is located ahead of the loudness control and the tone controls. If the recorder output is used with the selector switch in the "Phono" position, the push-button record equalizers and scratch filter may be used. Hence the recorded material, when played back, will have the proper equalization.

With the selector switch in the "Tape" position—for playback—the recorder output is automatically disconnected. The reason for this is that many recorders use interrelated recording and playback amplifier circuitry so that during playback, a feedback situation can develop. Usually, the *recorder's* input is fed from an *amplifier's* recording output, which in turn, is connected internally to the *amplifier* input being fed from the *recorder* output. To break this feedback loop, it is necessary to remove the recording cable from one of the jacks; or, as is done in the S-1000, the recording output must be automatically disconnected by the selector switch in the tape position.

Monitoring while recording remains entirely flexible since the loudness and tone control functions are independent of the signal to the recorder.

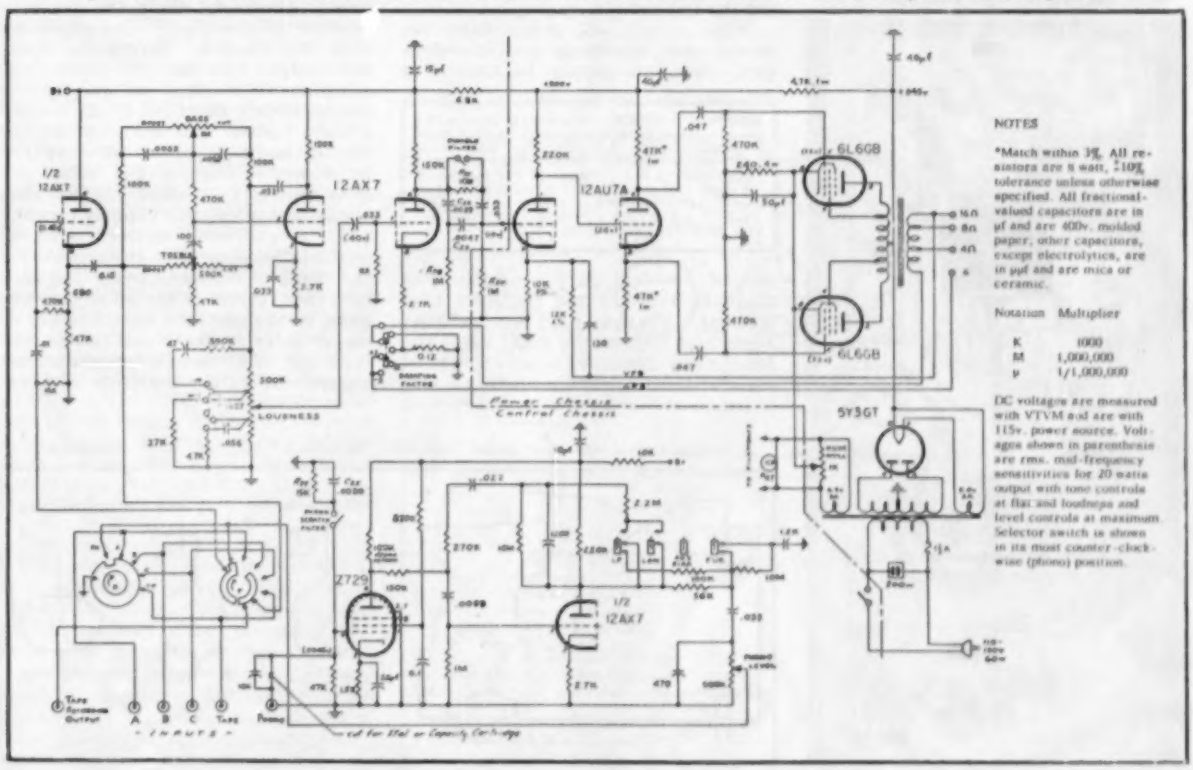
Even tone controls have various degrees of refinement. Some of the disadvantages of the popular combination bass-treble losser circuit[1] are: (1) poor

(*Continued on page* 122)



**Rear and bottom views of the S-1000 amplifier chassis. Dimensions are 14" x 10½" x 4".**

**Fig. 3. Schematic of the Sherwood Model S-1000 amplifier. The Z729 tube is a low-noise, low-microphonic British input tube.**



# AN R/C RECEIVER FOR MODEL BOATS

By PETER J. VOGELGESANG



The author's 30" model of a "Catalina" cabin cruiser which houses receiver. With a 32" antenna and 3-watt transmitter, operation up to a mile was obtained easily, safely.

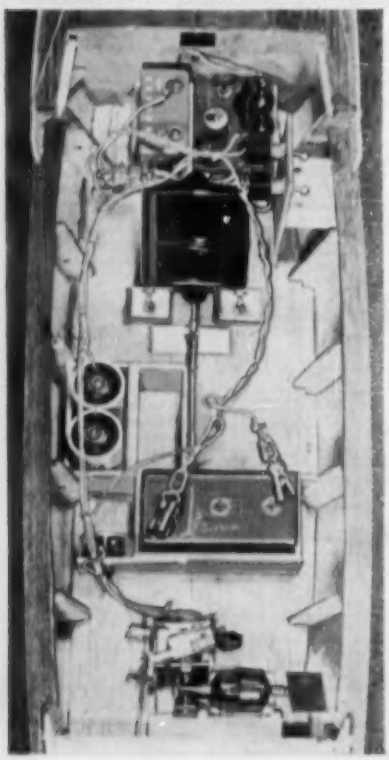
*Designed to be used with any 27.255 mc. radio-control transmitter, this compact, lightweight receiver and its associated escapement offers a wide margin of safety.*

MANY enthusiastic model builders undertake to radio control their models with the promise of many hours of enjoyment only to find that unreliable equipment turns fun to frustration. Nothing is quite so disappointing and discouraging as a model that responds to the controls only half the time. To really enjoy radio-controlled models, the equipment must be reliable above all else.

The severe restriction in size and weight of the radio receiver is the greatest difficulty to surmount in building reliable equipment. Tube and battery complement must be kept low, and heavy relays must be eliminated. The receiver must be sensitive and at the same time display a tolerance to wide changes in battery voltages.

Construction of a reliable transmitter is not nearly so difficult because size and weight are of little importance, and the unit can be constructed as elaborately as necessary to produce the desired results.

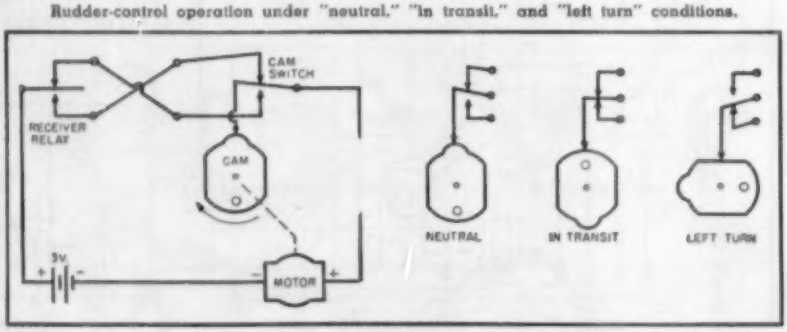
Interior view of the model boat showing how the equipment is installed for maximum trim and for easiest servicing work.



While almost all radio-control receivers are superregenerative detectors, they can usually be classed in one of two categories, namely, the gas tube receiver and the hard tube receiver. The gas tube receiver uses a gas tube such as the RK61 while the hard tube receiver uses only hard vacuum tubes generally of the 1.5 volt filament, miniature variety. Each kind of receiver has distinct advantages and disadvantages. For example, a single gas tube will display as much sensitivity as two or three vacuum tubes. Obviously, then, the gas tube receiver utilizes far fewer components with the resultant savings in space and weight and battery power consumption. However, the gas tube is comparatively short lived. At 1 milliampere plate current, fifteen or twenty hours is about all that can be expected from a gas tube, and even during that short life its electrical characteristics change continually. A gas tube receiver must be continually adjusted to compensate for the changing characteristics. The hard tube receiver, while not usually as sensitive as the gas tube type, and not as conservative of space and power consumption, will remain in permanent adjustment during hundreds of hours of operation.

*EDITOR'S NOTE: This article covers the construction of a receiver for radio control applications. It may be used with any commercial R/C transmitter designed to operate on the Citizens 27.255 mc. band or with the transmitter described in the December issue of our sister publication, POPULAR ELECTRONICS ("The Lorenz R/C Transmitter").*

Rudder-control operation under "neutral," "in transit," and "left turn" conditions.



In all receivers, gas tube and hard tube alike, it seems to be the general opinion that a relay current differential of 1 milliampere is adequate. However, only the most sensitive and critically adjusted relay will operate satisfactorily with such a small current differential. Such a relay is susceptible to vibration, shock, dust particles and almost any minute disturbing influences. To function reliably, a relay should operate from a current differential of at least three or four milliamperes.

All these factors must be considered in designing a reliable receiver. The receiver diagrammed and described in this article uses a radically different approach in order to extract the advantages of both the gas tube and hard tube. While an RK61 gas tube is used as the detector, it is operated at such a low plate current that its life is extended many times. The life of a gas tube is a function of the current it conducts, and with a plate current of less than .3 milliampere the tube life is extended well beyond a hundred hours. A gas tube operated as a superregenerative detector produces random noise pulses which disappear upon reception of an r.f. signal. The amplitude of these noise pulses remains constant irrespective of changes in plate current, but their repetition rate increases as the plate current increases. In the circuit illustrated, these noise pulses are capacity-coupled to an amplifier ($V_1$) where they are both amplified and clipped. They appear at the plate of $V_2$ as rectangular pulses about 20 volts in amplitude. From the amplifier they are coupled to the top of the voltage divider, $R_6$ and $R_7$. This same point is returned to the diode of $V_3$. The diode clamps the pulses and causes a negative 20 volts to be developed across the voltage divider. A portion of this voltage (about 15 volts) is tapped off the divider, filtered, and applied to the grid of the relay puller, $V_3$. Since negative 15 volts is sufficient to cut off $V_3$, the relay remains open and the entire receiver draws about .4 milliampere without signal. Upon reception of a signal the detector stops producing noise pulses, the bias on $V_3$ disappears and the relay closes with about 5 milliamperes plate current. Thus, a five milliampere relay current differential is realized from a standby current of less than .4 milliampere!! Such a large relay current differential enables the use of a small, hermetically sealed, plug-in type relay. This relay is rugged and presents no problems insofar as shock and difficult adjustments are concerned.

Thus the receiver retains the excellent sensitivity of the RK61 while eliminating its short life characteristic. About the only disadvantage of the receiver is the comparatively high filament current requirement. A single standard flashlight cell will operate the receiver for a few hours which is more than sufficient for airplane use. In a boat or similar model where weight is not so important, two or more cells can be paralleled. A single miniature 67½ volt "B" battery gives almost shelf life.

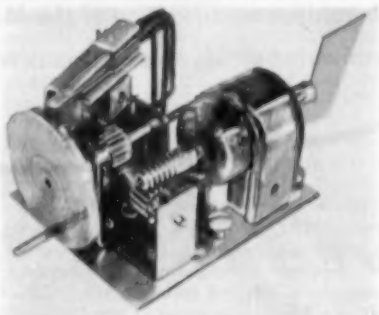


**Over-all view of receiver which is constructed on a Formica chassis measuring 3" long and 2" wide. The chassis sets into a balsawood box 1½ inches in depth**

The receiver is installed in a 30' model of a "Catalina" cabin cruiser. With a 32 inch antenna and a three-watt transmitter on 27.255 megacycles, unfailing results were obtained at one mile, a distance at which the boat was completely invisible to the transmitter operator.

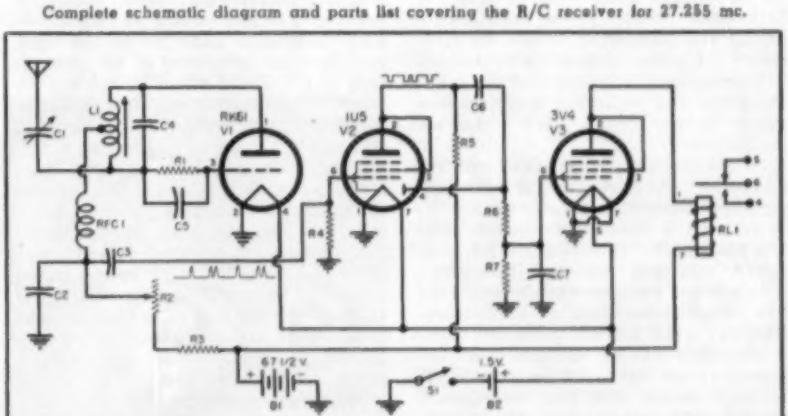
The receiver is constructed on a Formica chassis three inches long and two inches wide. The chassis sets into a balsawood box one and one-half inches deep. Three 7-pin sockets mount the two vacuum tubes and the plug-in relay. The phenolic inserts of the sockets were removed from the metal shells and cemented directly to the Formica chassis. This eliminates both size and weight and the necessity for additional hardware. The RK61 is pressed into a large rubber grommet and the wire

(*Continued on page* 114)



**Close-up view of the motor driven rudder-control. See diagram on opposite page.**

**Complete schematic diagram and parts list covering the R/C receiver for 27.255 mc.**




*$R_1$, $R_7$—3.3 megohm, ½ w. res.*
*$R_2$—100,000 ohm pot*
*$R_3$—10,000 ohm, ½ w. res.*
*$R_4$—6.8 megohm, ½ w. res.*
*$R_5$—220,000 ohm, ½ w. res.*
*$R_6$—2.2 megohm, ½ w. res.*
*$C_1$—1-10 μμfd. trimmer capacitor*
*$C_2$—.1 μfd., 200 v. metallized paper capacitor*
*$C_4$, $C_5$, $C_7$—.01 μfd., 200 v. metallized paper capacitor*
*$C_3$—15 μμfd. mica capacitor*
*$C_6$—100 μμfd. mica capacitor*
*RL1—Subminiature relay, 10,000 ohm coil @ 2.7 ma. (Potter & Brumfield SMSLS)*
*$L_1$—14 t. #22 en. on ⅛" dia., slug-tuned form, closewound*
*RFC1—100 μhy. r.f. choke*
*$S_1$—S.p.s.t. switch*
*$B_1$—67½ v. "B" battery*
*$B_2$—1.5 v. "A" battery*
*$V_1$—RK61 tube*
*$V_2$—1U5 tube*
*$V_3$—3V4 tube*

# V.H.F.-U.H.F. TV GENERATOR

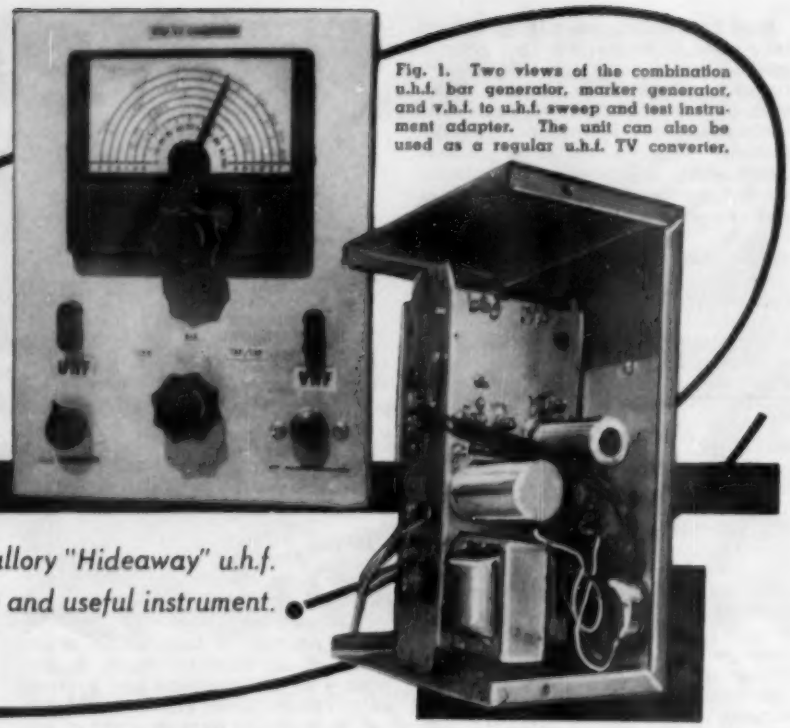


Fig. 1. Two views of the combination u.h.f. bar generator, marker generator, and v.h.f. to u.h.f. sweep and test instrument adapter. The unit can also be used as a regular u.h.f. TV converter.

By **BRUCE A. MORRISSETTE**

*Ingenious modification of the Mallory "Hideaway" u.h.f. converter yields this inexpensive and useful instrument.*

CONTINUING high costs of u.h.f. test equipment have forced many service technicians and experimenters to depend on weak u.h.f. harmonics from their present v.h.f. signal and sweep generators, or to forego entirely all attempts to test and align the tuned circuits of u.h.f. tuners and converters. Several medium-priced adapter units have appeared on the market, such as the *Philco* v.h.f. to u.h.f. generator adapter described in the September 1953 issue of RADIO & TELEVISION NEWS. These instruments permit the technician to use an ordinary v.h.f. sweep generator to develop alignment curves throughout the u.h.f. spectrum, and represent a step downwards in the cost of u.h.f. service equipment.

An inexpensive, home-assembled v.h.f.-u.h.f. TV generator of outstanding performance is shown in Fig. 1. Based on the readily obtainable *Mallory* Model 188 "Hideaway" u.h.f. converter, this unit has *four* functions: (1) u.h.f. bar generator producing from 2 to 14 horizontal bars on u.h.f. channels; (2) u.h.f. marker generator providing pure r.f. at fundamental frequencies from 400 to 800 mc.; (3) v.h.f. to u.h.f. sweep and test instrument adapter converting any v.h.f. sweep signal in the 75-90 mc. range to any u.h.f. channel frequency from channel 14 to 83; and (4) a regular u.h.f. converter to allow viewing any u.h.f. picture signal on an ordinary TV set tuned to channel 5 or 6.

Construction of the instrument is made convenient and practical by the fact that the builder is not required to do any u.h.f. wiring. A few changes in switch connections, plus the addition of five resistors, three capacitors, one variable control, and a turret socket, and the chassis is fully remodeled. An 8"x6"x3½" aluminum "Minibox" houses the v.h.f.-u.h.f. unit and provides all the necessary r.f. shielding.

### Theory and Operation

The v.h.f.-u.h.f. generator when used as a u.h.f. adapter for test and sweep instruments functions more or less as a u.h.f. converter in reverse, that is, it accepts a v.h.f. sweep signal at its v.h.f. terminals, adds to this the u.h.f. fundamental frequency of its own, filters out the difference frequency or other spurious frequencies that arise in the mixing process, and presents a swept u.h.f. frequency at its u.h.f. terminals. This u.h.f. sweep signal may be placed anywhere in the u.h.f. channel spectrum by tuning the v.h.f.-u.h.f. generator dial. Since the original Model 188 converter is designed to work into channel 5 or 6, the v.h.f. swept signal should be in this range, roughly, from 75-90 mc. It may be of any convenient bandwidth, usually about 10-15 mc. Unlike the harmonics of ordinary v.h.f. sweep generators used at u.h.f., the swept signals from the v.h.f.-u.h.f. generator have the same sweep width as the v.h.f. sweep signal fed into the unit.

Notice that the u.h.f. converter used must be capable of passing a signal in the backward as well as the forward direction in order to serve as the basic unit of a v.h.f.-u.h.f. generator. This means that converters embodying an amplifier tube are ruled out, unless considerable revision of the circuit is undertaken. The *Mallory* Model 188 is ideally suited for the present job, since it not only functions in either direction, but it has a spare socket hole already punched. Also, it has exceptionally good bandwidth, necessary to maintain undistorted flat sweep output, and a 180-degree tuning mechanism. This latter characteristic is important if a standard calibration dial is to be added.

A typical testing setup for aligning a u.h.f. tuner or converter is shown in Fig. 3. The v.h.f. sweep generator manual should be consulted for the proper way to provide balanced 300-ohm output, which is fed into the v.h.f. terminals of the v.h.f.-u.h.f. generator through a regular *Mosely* plug that fits the crystal-holder type terminals. If no instructions are available, use a 120-ohm resistor in each lead to the v.h.f. terminals, or make up a 50- to 300-ohm adapter box ("balun") from a *Merit* TV-170 transformer. The u.h.f. output is taken from the appropriate terminals of the v.h.f.-u.h.f. generator and fed through 300-ohm line to the antenna terminals of the u.h.f. tuner or converter. Set the v.h.f. sweep generator to sweep approximately 75-85 mc. and set the v.h.f.-u.h.f. dial to the desired u.h.f. channel frequency *minus* this amount. Alignment should be checked at low, medium, and high u.h.f. channels. If markers are desired, another unit similar to the v.h.f.-u.h.f. generator (it does not need to have the bar generator feature), or any u.h.f. marker generator may be used as may harmonics from a v.h.f. signal generator.

Alignment curves may be taken for

scope presentation either at the video detector of the TV set (in which case caution and experience are needed to interpret them properly) or through a crystal demodulator probe at the output of the u.h.f. tuner or converter itself. This latter procedure is the best, and is entirely practicable, because of the high u.h.f. output of the v.h.f.-u.h.f. unit. In fact, one may view the u.h.f. sweep signal itself at the output terminals of the unit, provided the crystal probe is sensitive and the scope has a two-stage amplifier. This output will be found to be remarkably flat, as evidenced by the appearance of two equidistant lines on the scope.

## Circuit and Construction

The original *Mallory* Model 188 converter is provided with double preselection by the selector tuned lines located between the antenna input and the mixer crystal (see Fig. 4). A 6AF4 u.h.f. oscillator operates from 75 to 90 mc. below the signal frequency, in order to preserve the correct relationship between video and sound carriers in the converted v.h.f. output. The oscillator and preselector tuned lines are ganged to a shaft which is ordinarily equipped with a large plastic dial visible over the top or around the side of the TV set. The channel 5 or 6 difference frequency developed in the 1N82 mixer crystal is presented to the v.h.f. terminals by way of the balanced output transformer provided. This transformer, incidentally, is in a large measure responsible for the excellent bandwidth characteristics of the Model 188.

In the modified unit the action of the function switch is simplified and the horizontal bar modulation feature is added. Inspection of Fig. 4, the schematic of the completed unit, will show that the v.h.f. and u.h.f. terminals are permanently wired to their panel connectors. Connect the original leads running between the output transformer and the function switch to the TV set terminals on the back of the Model 188 chassis. The function switch itself is rewired to provide off, bar, and v.h.f.-u.h.f. functions. Position three (v.h.f.-u.h.f.) serves as a marker generator, sweep adapter, and regular u.h.f. converter. In this position, heater and plate voltages are removed from the 6J6 bar modulator tube, allowing the power transformer to run cool during long periods of use as a u.h.f. converter.

The added circuit within the dotted lines is a Belgian multivibrator adapted for use as a variable horizontal bar modulator. The circuit produces a stable, clean-cut square-wave output which may be varied by $R_8$ from approximately 120 to 800 cycles per second. The other grid (pin 6) is synchronized with the 60-cycle line by coupling through the .01 μfd. ceramic capacitor, $C_9$, connected to the active heater pin 3. As the bar control is rotated, the multivibrator falls into sync with successive numbers of lines. Up to 14 horizontal lines may be produced. The large output coupling capacitor $C_7$ (16 μfd.) preserves the steep edges and flat tops of the modulation waves, giving an unusually sharp and contrasty bar pattern of the type shown in Fig. 5.

As a portable u.h.f. bar generator, the unit permits the testing and adjustment of the u.h.f. portions of all-channel receivers, as well as of u.h.f. converters, in the absence of a local u.h.f. program. Usually it is sufficient to connect a short length of wire to one or the other u.h.f. output terminals of the instrument to allow the u.h.f. bar signal to be radiated through the air to the TV receiver. In case of gross lack of sensitivity or maladjustment, the u.h.f. terminals of the generator may be connected directly to the antenna terminals on the TV set to provide a bar signal powerful enough to force itself through any u.h.f. circuits that are not completely dead. The r.f. and u.h.f. oscillator trimmers may be tuned for maximum response, and vertical linearity may be adjusted using the bar signal. Since the 6AF4 oscillator, by the nature of the converter design, tunes to only slightly past 800 mc., no bar patterns are available above channel 70 on fundamental frequencies. If it is desired to check a tuner at such a high u.h.f. setting, use the second harmonic of the bar generator by reverting to the low frequency end of the dial.

Since the Model 188 chassis conveniently contains an unused 7-pin socket hole adjacent to the function switch, no drilling is required to install the turret-type socket on which the components of the bar modulator circuit are mounted. With the exception of $R_1$ (mounted on the function switch), $C_1$ (placed below the chassis), and $R_8$ (installed on the front panel), all bar modulator resistors and capacitors are wired vertically around a 7-pin turret socket. As shown in Fig. 2, the vector socket is mounted upside down, with the components above the chassis and the 6J6 tube projecting below the chassis. The reason for this is to avoid crowding below the chassis and to leave undisturbed the delicate output transformer. Rotate the turret socket after it is wired until it fits snugly into the pre-drilled hole. If necessary, drill one mounting hole for a screw to retain the socket firmly. Plate, output, and heater lead wires are brought down through one of the several chassis holes near the socket and connected to appropriate points below the chassis. Connect the bar control potentiometer so that clockwise rotation decreases the amount of resistance in the circuit and thus causes more horizontal lines to appear in the bar pattern.

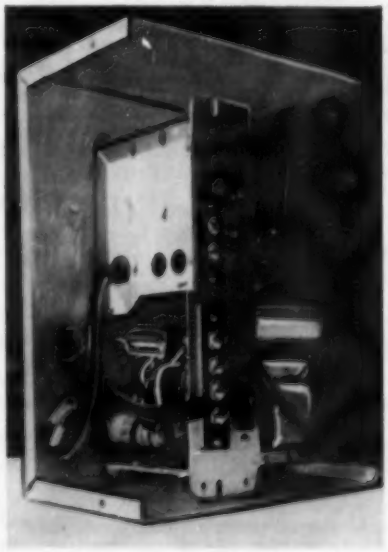


**Fig. 2. Interior view of the adapter showing the Mallory Model 188 converter mounted vertically against the front panel of the instrument. Note the bar modulator tube mounted on the underside of the converter chassis. The bottom of the turret socket for this tube is shown in Fig. 1. Note, also, the coaxial marker output cable.**

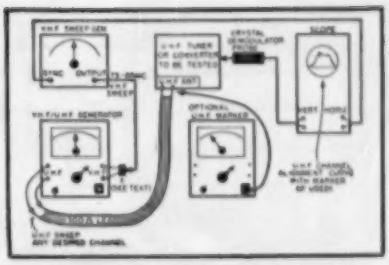
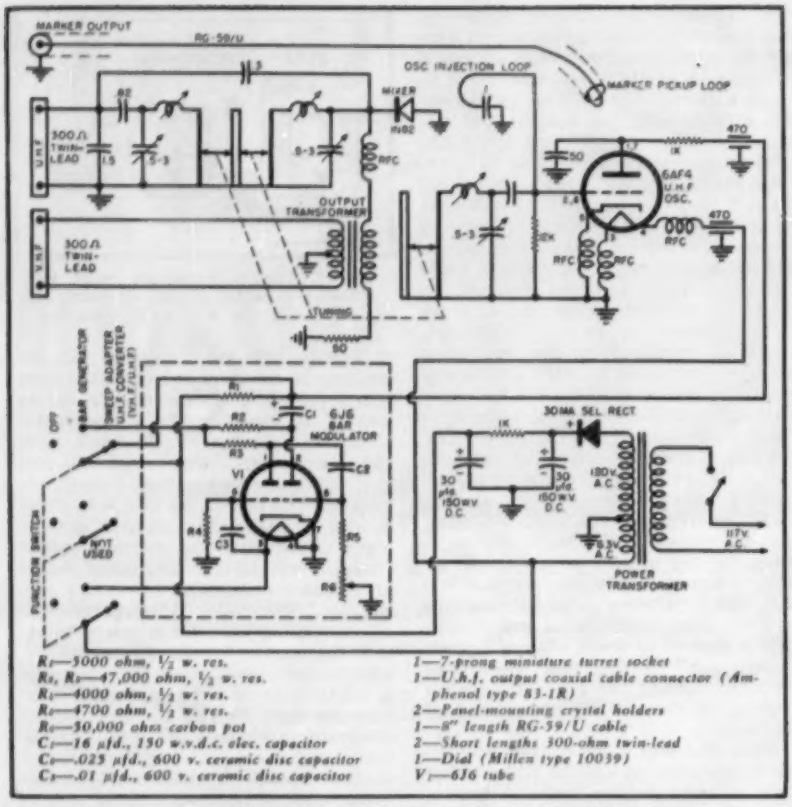


**Fig. 3. Typical instrument setup for aligning or testing a u.h.f. converter or tuner using the v.h.f.-u.h.f. generator.**

High level r.f. output for u.h.f. marker and other purposes is obtained by fashioning a small coupling loop at the end of a short length of RG-59/U cable, and inserting this loop into the 6AF4 oscillator compartment through the adjustment hole already present, as shown in Fig. 2. The solid inner conductor of the cable is bent in an arc about ¼" in diameter and soldered to the cable shield. An *Amphenol* type 83-1R panel connector terminates the cable. To secure maximum uniform output, connect a good u.h.f. crystal (such as the 1N82) in series with the output and a microammeter. Then rotate the coupling loop inside the oscillator compartment while watching the meter. A point will be found that produces a strong r.f. signal of fairly uniform output throughout the tuning range. If the rectified current through the crystal runs between 50 and 100 microamperes, it may be assumed that the output is sufficient for all service and experimental purposes. A rubber grommet in the cable hole will give a snug fit and prevent the cable from twisting away from the best adjustment point.

Details of mounting the dial and other panel elements may be observed in Figs. 1 and 2. Place the 188 chassis vertically in the instrument box and carefully locate the two shaft holes. Then install the dial. The shaft nut of the function switch is sufficient to hold the chassis to the box at the bottom, but at the top a small retaining screw




*$R_1$—5000 ohm, ½ w. res.*
*$R_2$, $R_3$—47,000 ohm, ½ w. res.*
*$R_4$—4000 ohm, ½ w. res.*
*$R_5$—4700 ohm, ½ w. res.*
*$R_6$—50,000 ohm carbon pot*
*$C_1$—16 μfd., 150 w.v.d.c. elec. capacitor*
*$C_2$—.025 μfd., 600 v. ceramic disc capacitor*
*$C_3$—.01 μfd., 600 v. ceramic disc capacitor*
*1—7-prong miniature turret socket*
*1—U.h.f. output coaxial cable connector (Amphenol type 83-1R)*
*2—Panel-mounting crystal holders*
*1—8" length RG-59/U cable*
*2—Short lengths 300-ohm twin-lead*
*1—Dial (Millen type 10039)*
*$V_1$—6J6 tube*

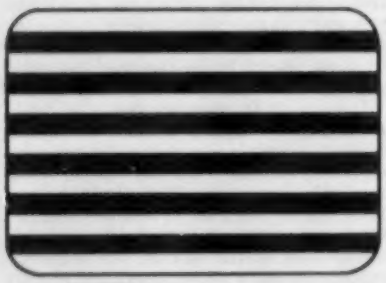
**Fig. 4. Complete schematic diagram of the modified Mallory Model 188 u.h.f. converter, and the added bar modulator, with the parts list for the latter.**

is installed behind the dial, secured by a nut behind one of the chassis flanges. The two crystal sockets are coupled by short lengths of 300-ohm lead to the appropriate terminals on the rear of the 188 chassis. Labels for the panel may be typed on stiff white card material or cut from magazine illustrations, like those shown.

## Calibration

An accurate indication of absolute frequency of the oscillator is the most useful type of calibration for this instrument. If the v.h.f. sweep input frequency is always kept constant at, say, 75-85 mc., it might be desirable to provide an additional ring of calibrations corresponding to the output u.h.f. sweep frequency, perhaps in terms of u.h.f. channel numbers. For marker purposes however, an absolute frequency indication is essential, and with the absolute frequency known, one may always compute the frequency of any sum output. This frequency may then be checked against any convenient list of u.h.f. channels and their video and sound carriers.

**Fig. 5. Horizontal bar pattern produced by the v.h.f.-u.h.f. generator on u.h.f. channels, useful for making u.h.f. adjustments on all-channel receivers in the absence of a transmitted station signal.**



Calibration of home-constructed test instruments always poses a problem, unless the builder is well provided with equipment. The following method was used by the author to establish accurate 50 mc. points on the generator, and the method may be extended to secure finer divisions of frequency.

First, a signal generator was set to exact zero beat with the 5 mc. transmission from WWV, as determined by listening to the beat note on a small communications receiver. Next, another oscillator was set to exactly 50 mc., as determined by zero beating with the first (5 mc.) oscillator through a crystal probe connected to a high-gain scope. Precautions must be taken to be sure you are dealing with fundamentals of 5 and 50 mc., and not 5 and 45 mc., for example. A prechecked grid-dip meter or trustworthy absorption wavemeter may be used to insure that the 50 mc. point is not 45 or 55 mc.

When the 50 mc. oscillator has been calibrated, its output is fed, together with that of the v.h.f.-u.h.f. generator (taken from the coaxial output connector), to a crystal probe connected to a scope (or even to headphones if a scope is not available). Starting with the low-frequency, counterclockwise, end of the dial, tune slowly until the first beat note is seen (or heard). This will be, unless the 188 oscillator unit has been tampered with, 400 mc. Continue tuning and mark 50 mc. points across the dial. The last one should be 800 mc. Further refinements of calibration are left to the ingenuity of the reader. Note, however, that if a u.h.f. station is on the air in your vicinity, you may exactly mark its video and audio carrier points by coupling the v.h.f.-u.h.f. generator loosely to a TV set tuned to the u.h.f. channel and watching the screen as you dial. At exact video zero beat, the picture looks as if a piece of silk were stretched across the picture tube. On either side of zero beat, herringbone lines will be seen. At exact r.f. coincidence with the audio carrier a sudden sharp drop will be noted in audio level. The two points thus obtained may be marked precisely on the v.h.f.-u.h.f. dial. Since the Model 188 oscillator is extremely stable, all dial calibrations may be counted on to retain their accuracy.

## High U.H.F. Channels

For the benefit of those who live in areas where there are u.h.f. channels above 70 and none between 14 and 24, a slight modification of the converter will enable it to furnish markers and horizontal bars on fundamental frequencies at the higher channels. To do this, the range of the 6AF4 oscillator must be shifted from approximately 385-805 mc. to a new range of 470-920 mc. It will no longer be possible to obtain flat u.h.f. sweep frequencies throughout the u.h.f. spectrum, although sweep frequencies for specific u.h.f. channels may still be developed.

To make the change, remove the small bent metal strip inductance between the oscillator grid trimmer capacitor and the tuning mechanism, represented by the variable inductor in the grid circuit of the 6AF4 in Fig. 4. Remove the oscillator grid trimmer capacitor. Using a bit of the metal strip, make the shortest possible connection between the ceramic grid blocking capacitor mounted between pins 2 and 6 of the 6AF4, and the tuning mechanism. The oscillator should now have a tuning range of 470 to 920 mc.

Since the oscillator and preselector tracking will have been impaired by this change, it will be necessary to set the preselector to a desired u.h.f. sweeping range by tuning the associated trimmer capacitors. Good results should then be possible when using this instrument, so modified, to obtain horizontal bars and marker signals on the higher u.h.f. channels.

The v.h.f.-u.h.f. TV generator should find grateful acceptance among technicians and experimenters eager to acquire a versatile u.h.f. instrument of high quality at low cost. —30—



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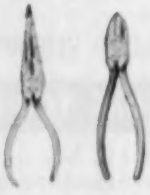

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# "MISSIONARY VOICE IN HAITI" MARKS ANNIVERSARY

By KENNETH R. BOORD

*Short-Wave Listeners to be honored by special series of programs May 20, 21, and 22 over Station 4VEH, Haiti.*

RADIO Station 4VEH, "La Voix Evangelique d'Haiti," of the East and West Indies Bible Mission, Box 1, Cap Haitien, Haiti, has planned a series of special anniversary and DX broadcasts for the weekend beginning Friday, May 20. The series is being arranged by 4VEH's technical director, M. E. Picazo, in cooperation with a RADIO & TELEVISION NEWS monitor, Stewart C. West of Union, New Jersey.

The Anniversary broadcasts—in *English*, French, and Spanish—will be radiated to commemorate 4VEH's fifth year on the air. The DX Program is designed to honor the 25th Anniversary of the *International Short-Wave Club*, London, England, one of the oldest radio clubs in the world and which was started in 1929 in the United States; and also to honor all short-wave listeners, radio clubs, and publications—including RADIO & TELEVISION NEWS—that have helped 4VEH during the past five years with reception reports, publicity, and in other ways. Tentatively, the DX Program will include a congratulatory message from, and a brief group of organ melodies played by Ken Boord, former short-wave editor of RADIO & TELEVISION NEWS. And there will be a special dedication to Albert K. (Ab) Saylor, Quantico, Virginia, a veteran monitor who has assisted 4VEH station personnel in many ways over the years.

Mr. Picazo says 4VEH "would like to have reception reports from any listeners who are able to pick up any of these broadcasts. Comparative reports between various transmissions are especially needed." All correct reports of any 4VEH broadcast will be verified with a QSL card.

If an International Reply Coupon (IRC), which costs 13 cents at any U.S. post office, is enclosed with the report, the verification card will be sent by airmail.

Reports should be addressed to Radio Station 4VEH, Box 1, Cap Haitien, Haiti, West Indies.

"A secondary purpose in making these special broadcasts is to find out how well 4VEH can be heard at various times of the day in all parts of the world," Mr. West explains. "It is commonly known that propagation conditions change from day to night and so on. Hence, comparative reports on as many transmissions as possible from listeners wherever the broadcasts can be heard will be welcomed by 4VEH. These reports will be useful to help plan for future extension of broadcasting schedules over 4VEH for listeners who now do not hear the station at a good level." With the completion of a 10 kw. short-wave transmitter—for use in the 19-meter band—these plans will be put into effect gradually, according to Mr. Picazo.

Here is a listing of the planned broadcast schedule for 4VEH during the "Anniversary Weekend" of May 20-23, all times given in *GMT* (*subtract* 5 hours for *EST*, 6 for *CST*, 7 for *MST*, and 8 for *PST*):

Friday, May 20, at 1030-1430 and 2300-0230 Saturday, May 21, Regular Schedule, on 9.639 in the 31-meter band; 0230-0400, Special Anniversary Schedule, 9.639; 0550-0800, Special Anniversary Schedule, 9.642; 0850-1045, Special Anniversary Schedule, 9.633; 1045-1515, Regular Schedule, including Special Broadcasts, 9.639; 2145-2300, Special Anniversary Schedule, 9.639; 2300-0230 Sunday, May 22, Regular Schedule, including Special Broadcasts, 9.639; 2015-0230 Monday, May 23, Regular Schedule, 9.639.

The transmissions listed in the preceding paragraph will be radiated in the 31-meter band on the "probable" channels given. If by May 20 the *new* 49-meter band transmitter is ready for use, it also will be employed for these transmissions, and possibly a low-powered transmitter (300 watts) will be put into use on the 19-meter band for the series of special broadcasts. As indicated earlier, the 9.639 frequency will be shifted slightly to give European and Pacific listeners a chance to hear 4VEH "away" from stations in those respective areas.

Here is the broadcast schedule for the Anniversary Programs:

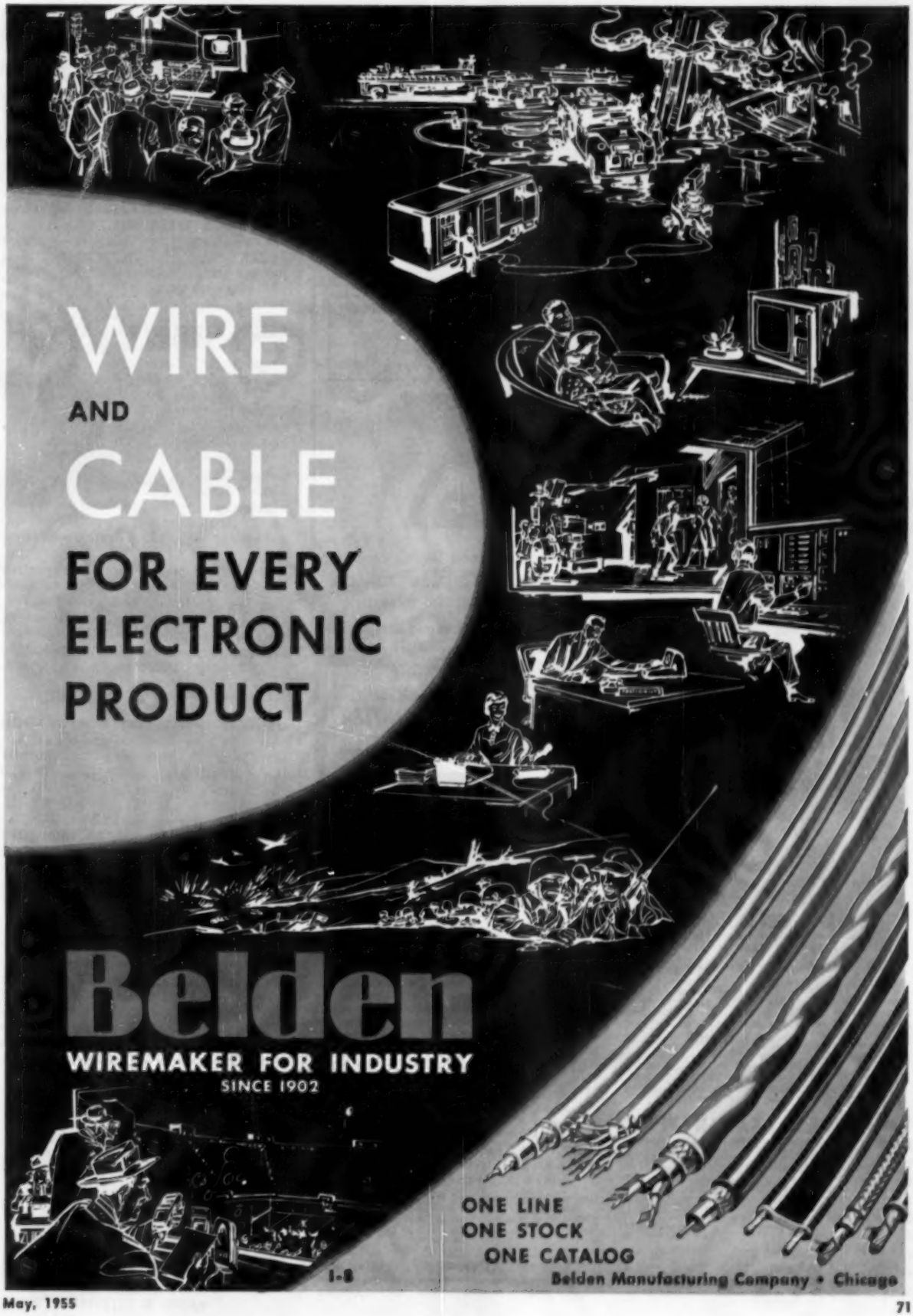
Saturday, May 21, 0230-0300, Anniversary Program; 0300-0315, Haiti Sings; 0315-0345, DX Program; 0345-0400, Favorite Hymns; sign-off 0405; 0550-0600, sign-on; 0600-0615, Anniversary Program in French; 0615-0630, Haiti Sings; 0630-0700; DX Program; 0700-0715, Favorite Hymns; 0715-0745, Anniversary Program; 0745-0800, music; sign-off 0800; 0850-0900, sign-on; 0900-0915, Greetings to Mission in New Guinea; 0915-0945, DX Program; 0945-1000, Favorite Hymns; 1000-1030, Anniversary Program; 1030-1045, Haiti Sings; 1115-1130, Anniversary Program in French; 1200-1230, Anniversary Program in Spanish; 1330-1400, Anniversary Program; 1430-1500, DX Program; sign-off 1500; 2145-2200, sign-on; 2200-2330, DX Program; 2230-2315, Haiti Sings; 2315-2330, Anniversary Program in French. Sunday, May 22, 0000-0030, Anniversary Program in Spanish. (All programs listed are in English unless otherwise cited.)

Current regular schedules of the station on 9.639 are:

Sunday—1030-1430, 2015-0230 (Mon.). Monday — 1030-1430, 2300-0230 (Tues.). Tuesday—1030-1430, 2300-0230 (Wed.). Wednesday — 1030-1430. Thursday — Silent Day. Friday—1030-1430, 2300-0230 (Sat.). Saturday—1030-1515, 2300-0230 (Sun.). Regular broadcasts are presented in *English*, Spanish, French, and Creole. Has Mailbag Session on Saturday near the end of the first ("morning") transmission, which may be repeated in the second ("evening") transmission on Monday.

Announcements by 4VEH are: *English*—"You are listening to Radio Station 4VEH, located in Cap Haitien, Haiti." Spanish—"Eschucha usted la radioifusora 4VEH situada en Cabo Haitiano, Republica de Haiti." French—"C'est la Voix Evangelique d'Haiti, station radiodiffusion 4VEH, Cap Haitien, Haiti."

Leading personalities of the station include G. T. Bustin, director and president; M. E. Picazo, technical director, and Mrs. M. E. Picazo, director of *English programs*. —30—

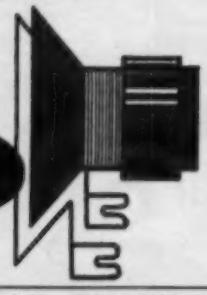

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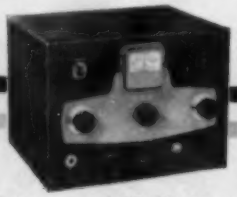
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## Within the Industry

(*Continued from page 26*)

Avenue, New York City . . . **INTERNATIONAL RESISTANCE COMPANY** has changed the name of its wholly-owned Florida subsidiary to **CIRCUIT INSTRUMENTS, INC.** It was formerly known as **VAN DYKE INSTRUMENTS, INC.** . . . Rollie Sherwood, formerly vice-president of **HALLICRAFTERS,** has organized **SHERWOOD SALES, INC.,** manufacturers' representatives, with head offices at 230 N. Canal St., Chicago, and branch offices in Cleveland, New York, and San Francisco.

* * *

**PETER L. STONE** has been elected president of *Allen D. Cardwell Electronics Productions Corp.*, replacing Ralph H. Soby who has resigned the post and been appointed special consultant.



The directors also named Richard O. Kennedy, Jr. as vice-president of *Cardwell* which is a Plainville, Conn. subsidiary of *Chesapeake Industries, Inc.*

Mr. Stone was formerly executive vice-president and a director of *Ludlow Manufacturing and Sales Co., Inc.* of Boston and prior to that was assistant to the president of *Harrisburg Machinery Corporation* and associated with *Sperry Gyroscope Co.* and *Crucible Steel Co. of America.*

* * *

**GENERAL INSTRUMENT CORPORATION** has built a new million-and-a-half dollar radio-TV-electronic components plant in Statesboro, Georgia. This is the firm's sixth plant in the U.S. and Canada. It is adaptable to either civilian or military production . . . The sales department of **WARD PRODUCTS CORP.** has moved its operations to Ashtabula, Ohio, where the plant is located . . . **THOMPSON PRODUCTS, INC.** is planning a five-million dollar engineering study center on a site just east of its plant at 23555 Euclid Avenue, Euclid, Ohio. The research center will be devoted to the development of new products, processes, and materials . . . The **UTICA DIVISION** of **BENDIX** has opened a $100,000 facility for the engineering, sales, and servicing of its products at 11600 Sherman Way in North Hollywood, California . . . **HAMMARLUND MANUFACTURING COMPANY, INC.** of New York has recently moved part of its manufacturing operations to a new plant in Mars Hill, N. C. . . . **RECOTON CORPORATION** is now occupying a new, modern building at 52-35 Barnett Ave. in Long Island City, N.Y. . . . **ATLAS RADIO CORPORATION LIMITED** of Canada has moved into a new plant at 50 Wingold Ave. in a new exclusive industrial area in North-West Toronto. The building provides 50,000 square feet of floor space.

—30—

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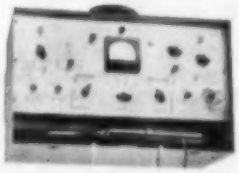
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# MAC'S RADIO SERVICE SHOP

By JOHN T. FRYE



## WHAT'S RIGHT WITH THE SERVICE BUSINESS

IMPATIENTLY Barney threw the pamphlet he was reading on the floor and turned to Mac, his employer:

"Mac, I'm beginning to wonder if I want to be a serviceman—or 'service technician' as I'm supposed to say—after all. Everything I read lately seems to tell what's wrong with the service business and the men in it. The independent serviceman especially is represented as a sort of business moron who not only fails to make any money for himself but—and this is a much more serious crime—prevents Big Time Operators from reaping the harvest they should.

"When I started with you, my first aim was to become a really good radio and TV man; then secondly, I hoped some day to start up a little shop of my own. Now it develops, according to a lot of this literature we get, there is no place for the one-man shop in the future of radio and TV servicing. The fellows who write this stuff say, or insinuate, the small shop owner can't buy the necessary equipment, can't secure the specialized training, and can't command the price that should be had for repairing sets. How about that? Is the future of the independent serviceman—if you'll excuse the expression—as black as all that?"

Before answering, Mac settled himself comfortably on the broad service bench and lighted his pipe. This was an encouraging omen to Barney, for Mac seldom smoked at work. When he did light up his beat-up old briar, this invariably meant he was preparing to sound off, at some length, on a subject to which he had given considerable thought.

"In a single word: No!" Mac began emphatically. "I've noticed, too, a strong calamity-howling tendency in some quarters regarding the future of the service business in general and the lot of the independent serviceman in particular. A lot of this beefing seems to be given off by a few who are trying to scare servicemen into joining their particular organizations.

"Now don't get me wrong. I haven't a thing against service organizations as such. In fact, I'm a great believer in the motto *In Union There Is Strength;* and I am confident that many of these service organizations are fine ones that provide their members with many worthwhile and valuable benefits. But these good organizations do not proselyte through fear, and they do not encourage one branch of the service business at the expense of another. They work for the good of *all* servicemen and do not arbitrarily try to rearrange the whole service shop pattern and the lives of the owners. To put it bluntly, they encourage growth with fertilizer rather than with the pruning knife.

"Personally, I'm proud to call myself an *independent serviceman.* Both of those words have a clear, true meaning for me. 'Independent' has been a pretty good word in the old U.S.A. for a long, long time, and it is going to take an awful lot of doing to give it a nasty connotation. Independent men built this country; and, for the most part, independent servicemen have done the majority of radio and TV servicing up to date. I'll not be at all surprised if they continue doing a large share of this business in the future.

"And I can see nothing wrong with the name 'serviceman.' I know there are some who hold that giving ourselves an impressive title, such as 'electronic technician' would increase our prestige and command respect, but I rather doubt it. You don't win respect that easily. Undertakers tried for years to make people call them 'morticians' or 'funeral directors'; but nine out of ten people still call them 'undertakers'; yet their over-all volume of business seems to hold up well. Foot specialists refer to each other as 'podiatrists,' but their customers think of them as 'foot doctors' and keep right on taking their sore tootsies to them for treatment. 'Efficiency expert' is a very important-sounding title, but this has not prevented the name from becoming the butt of countless jokes. It's not what you call yourself that matters; it's what your customers think of you. *Being* a technician is a lot more important than *calling* yourself one.

"*Serviceman* to me means just what it says. As the panel of *What's My Line* would have it, I 'deal in services.' Standing shoulder to shoulder with people like the physician and the garage mechanic, I perform an essential service for people that they cannot do for themselves.

"And that brings us to What's Right with the Service Business. Since I have been in it for well over a quarter of a century, I sort of feel that I have as much right to pop off on this subject as some of the guys who think they are 'old-timers' because they can remember away back to when we did not have solder guns. When I, and a lot more like me started repairing radios, we did our soldering with a regular tinner's iron heated in the burner of a gas stove.

"I'm not going to contend that many radio and TV servicemen have to pay surtax rates on their income; but neither do I know of any worth their salt who have starved to death or who cannot afford a decent car and a comfortable home. If they have attended to business and have kept up with developments in their field—as any good mechanic does as a matter of course—they are not afraid of what the future holds in store. In fact, things look brighter for them right now than it has at any time since they started in business.

"But if you are my kind of a serviceman, a lot of your income is of a sort that cannot be measured in dollars and cents. I firmly believe a top-notch serviceman is no more attracted into this field by the lure of rich monetary rewards than a fine doctor takes up his life's work solely to make money or a scientist chooses his calling just to pile up a big bank account. A good serviceman loves his work and gets a tremendous personal satisfaction out of restoring a piece of well-designed electronic equipment to first-class operating condition. This won't make sense to those who tell us we should be sharp businessmen first and good technicians second; but you know what I mean, and so does any other good mechanic or good technician or good whatever you want to call him.

"Let me put it another way: when I return a repaired radio to a shut-in and see the smile that lights up his face as he turns on the switch and this little electronic 'escape-hatch' from his sick-

(*Continued on page* 88)

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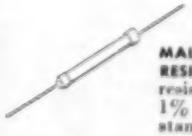
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# Technical BOOKS

**"ELECTRONIC MUSICAL INSTRUMENTS"** by Richard H. Dorf. Published by *Radio Magazines, Inc.*, P. O. Box 629A, Mineola, N. Y. 321 pages. Price $7.50.

For all those electronic musical instrument fans, here is a text which covers both commercially-available organs and the circuitry for two complete instruments that can be home-built.

There are four introductory chapters which cover the nature of music and musical instruments; basic musical facts; requirements of an instrument; and tone color.

Details and schematics are given for *Hammond, Baldwin, Minshall, Connsonata, Lowrey, Hammond* "Solovox", *Wurlitzer, Hammond* Chord Organ, *Allen*, and *Stroboconn* instruments. There is a chapter on installing and servicing such instruments and then details for constructing the "Thyratone" and the "Electronorgan". Three additional chapters are devoted to a discussion of electron-tube tone generator circuits, non-tube tone generators, tone coloring, amplification and control. An appendix listing electronic music patents and a bibliography complete the text.

This book will be of help to a diversified group ranging from committees responsible for the selection of instruments for churches and similar installations, to service technicians, to electronic music fans who want to experiment with the medium.

It is our impression that this is the first time that a book of this scope has been published on electronic musical instruments. It should prove to be a welcome addition to the libraries of all those with more than a passing interest in the field.

* * *

**"ELEMENTS OF RADIO SERVICING"** by William Marcus & Alex Levy. Published by *McGraw-Hill Company, Inc.*, New York. 557 pages. Price $6.00. Second Edition.

According to the RETMA, over ten million radio receivers were manufactured during 1954, which seems to indicate that the "patient" is far from moribund. Technicians who write off this radio servicing potential might be passing up a good source of income.

This second edition of a text originally published in 1947 reaffirms the authors' belief that radio servicing still has much to offer the technician and, as a result, this new book has been released to bring the radio servicing field up-to-date and to reflect the newer circuitry.

In addition to revising the basic chapters, new material has been added on battery and three-way portables and on FM receivers. One especially interesting innovation is the availability of six filmstrips to correlate and illustrate the oscillator, mixer, and parts used in a converter; how to use

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1—SR-5 BLILEY, 10,000 Kc. Reg. Value.$1.99
1—FT-243, 5,000 Kc. Reg. value..... 1.99
1—DC-15, 200 Kc. Reg. value..... 1.99
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| 2174 KC. DC-34..... | 2.00 | 3997 KC. DC-34..... | 2.00 |
| 2182 KC. DC-34..... | 2.00 | 3998 KC. DC-34..... | 2.00 |
| 2182 KC. FT-243..... | 2.00 | 3998 KC. FT-243..... | 2.00 |
| 2206 KC. DC-34..... | 2.00 | 3998 KC. FT-243..... | 2.00 |
| 2500 KC. FT-243..... | 1.99 | 3103 KC. FT-243..... | 2.00 |
| 2550 KC. DC-34..... | 2.00 | 3123 KC. DC-34..... | 2.00 |
| 2307 KC. DC-34..... | 2.00 | 3125 KC. DC-34..... | 2.00 |
| 2620 KC. DC-34..... | 2.00 | 3148 KC. FT-243..... | 2.00 |
| 2632 KC. FT-243..... | 2.00 | 3165 KC. DC-34..... | 2.00 |
| 2634 KC. DC-34..... | 2.00 | 3168 KC. FT-243..... | 2.00 |
| 2637 KC. FT-243..... | 2.00 | 3181 KC. FT-243..... | 2.00 |
| 2638 KC. DC-34..... | 2.00 | 3203 KC. FT-243..... | 2.00 |
| 2646 KC. FT-243..... | 2.00 | 3500 KC. FT-243..... | 1.99 |
| 2670 KC. DC-34..... | 2.00 | 10,000 KC. Type SR-5 Bliley, in CR-1 holder..... | 1.99 |
| 2670 KC. FT-243..... | 2.00 | | |

**NUMBERS LISTED ARE FUNDAMENTAL FREQUENCIES IN KILOCYCLES**



## FT-243

Lots of 10 or more. Ea.....
Lots of 5 or more. Ea....79c
Individually. Ea. .....99c

**69c**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1110 | 2570 | 2905 | 3240 | 4595 | 5782 5 | 6340 | 7073 3 | 7570 | 7773 3 | 8016 7 | 8260 | 8508 3 |
| 1139 | 2575 | 2910 | 3290 | 4710 | 5800 | 6350 | 7075 | 7575 | 7775 | 8020 | 8268 7 | 8510 |
| 1150 | 2580 | 2915 | 3110 | 4720 | 5805 7 | 6360 | 7080 | 7580 | 7780 | 8025 | 8270 | 8516 7 |
| 1195 | 2535 | 2920 | 3320 | 4780 | 5820 | 6373 3 | 7106 6 | 7533 3 | 7783 3 | 8030 | 8273 3 | 8520 |
| 1525 | 2545 | 2925 | 3340 | 4785 | 5825 | 6375 | 7125 | 7540 | 7790 | 8033 3 | 8275 | 8525 |
| 1900 | 2550 | 2930 | 3410 | 4815 | 5840 | 6400 | 7140 | 7541 7 | 7791 7 | 8040 | 8280 | 8530 |
| 1915 | 2567 | 2935 | 3420 | 4820 | 5850 | 6405 | 7150 | 7560 | 7800 | 8041 7 | 8283 3 | 8533 3 |
| 1930 | 2560 | 2940 | 3455 | 4840 | 5852 5 | 6406 6 | 7160 | 7550 3 | 7806 6 | 8050 | 8290 | 8540 |
| 1940 | 2565 | 2945 | 3465 | 4845 | 5860 | 6425 | 7173 3 | 7566 | 7808 3 | 8055 | 8291 7 | 8541 7 |
| 1950 | 2570 | 2950 | 3500 | 4852 5 | 5873 5 | 6440 | 7175 | 7566 7 | 7810 | 8060 | 8300 | 8550 |
| 1965 | 2575 | 2955 | 3510 | 4880 | 5875 | 6450 | 7200 | 7570 | 7816 7 | 8066 7 | 8306 6 | 8556 3 |
| 2015 | 2580 | 2960 | 3525 | 4900 | 5880 | 6473 3 | 7206 6 | 7573 3 | 7820 | 8070 | 8308 3 | 8560 |
| 2017 | 2585 | 2965 | 3540 | 4950 | 5892 5 | 6475 | 7225 | 7575 | 7825 | 8073 3 | 8310 | 8566 7 |
| 2030 | 2590 | 2970 | 3555 | 4956 | 5900 | 6500 | 7240 | 7580 | 7830 | 8075 | 8316 7 | 8570 |
| 2075 | 2595 | 2980 | 3580 | 4980 | 5906 7 | 6506 6 | 7250 | 7583 3 | 8000 | 8080 | 8320 | 8573 3 |
| 2035 | 2650 | 2985 | 3700 | 4995 | 5907 5 | 6525 | 7273 3 | 7580 | 7840 | 8083 3 | 8325 | 8575 |
| 2040 | 2655 | 2990 | 3760 | 5030 | 5925 | 6540 | 7275 | 7591 7 | 7841 7 | 8090 | 8330 | 8580 |
| 2055 | 2660 | 2995 | 3800 | 5035 | 5940 | 6550 | 7300 | 7600 | 7850 | 8091 7 | 8333 3 | 8583 3 |
| 2060 | 2665 | 3005 | 3805 | 5096 | 5950 | 6573 3 | 7306 6 | 7606 6 | 7854 3 | 8100 | 8340 | 8590 |
| 2065 | 2675 | 3010 | 3825 | 5127 5 | 5955 | 6575 | 7308 3 | 7608 3 | 7860 | 8106 6 | 8341 7 | 8591 7 |
| 2090 | 2680 | 3015 | 3955 | 5165 | 5973 3 | 6600 | 7316 7 | 7610 | 7866 7 | 8108 3 | 8350 | 8600 |
| 2105 | 2685 | 3020 | 3980 | 5180 | 5975 | 6606 6 | 7325 | 7616 7 | 7870 | 8110 | 8356 3 | 8606 6 |
| 2125 | 2690 | 3025 | 3990 | 5205 | 5995 | 6625 | 7333 3 | 7620 | 7873 3 | 8116 7 | 8360 | 8606 3 |
| 2130 | 2695 | 3030 | 3995 | 5235 | 6000 | 6640 | 7340 | 7625 | 7875 | 8120 | 8366 7 | 8610 |
| 2135 | 2705 | 3035 | 4035 | 5245 | 6006 6 | 6650 | 7341 7 | 7630 | 7880 | 8125 | 8370 | 8616 7 |
| 2140 | 2710 | 3040 | 4040 | 5275 | 6025 | 6673 3 | 7350 | 7640 | 7883 3 | 8130 | 8375 | 8620 |
| 2106 | 2715 | 3041 | 4060 | 5295 | 6040 | 6675 | 7356 3 | 7641 7 | 7890 | 8133 3 | 8380 | 8625 |
| 2300 | 2730 | 3060 | 4095 | 5300 | 6042 | 6700 | 7366 7 | 7650 | 7891 7 | 8140 | 8383 3 | 8630 |
| 2305 | 2750 | 3065 | 4110 | 5305 | 6050 | 6706 6 | 7633 3 | 7658 3 | 7900 | 8141 7 | 8390 | 8633 3 |
| 2320 | 2755 | 3060 | 4135 | 5327 5 | 6073 3 | 6725 | 7373 3 | 7640 | 7906 6 | 8150 | 8391 7 | 8640 |
| 2350 | 2760 | 3065 | 4165 | 5335 | 6075 | 6740 | 7375 | 7666 7 | 7908 3 | 8158 3 | 8400 | 8641 7 |
| 2255 | 2765 | 3070 | 4175 | 5385 | 6100 | 6750 | 7383 3 | 7670 | 7910 | 8160 | 8406 6 | 8650 |
| 2560 | 2770 | 3075 | 4190 | 5397 5 | 6106 6 | 6773 3 | 7391 7 | 7673 3 | 7916 7 | 8163 6 | 8408 3 | 8656 3 |
| 2366 | 2775 | 3090 | 4235 | 5435 | 6125 | 6775 | 7400 | 7675 | 7930 | 8166 7 | 8410 | 8666 |
| 2370 | 2780 | 3100 | 4250 | 5437 5 | 6140 | 6800 | 7406 | 7680 | 7935 | 8170 | 8416 7 | 8666 7 |
| 2375 | 2785 | 3110 | 4255 | 5480 | 6142 | 6806 6 | 7406 6 | 7683 3 | 7930 | 8173 3 | 8420 | 8670 |
| 2390 | 2790 | 3130 | 4280 | 5500 | 6150 | 6815 | 7408 3 | 7690 | 7941 7 | 8175 | 8425 | 8673 3 |
| 2415 | 2795 | 3135 | 4290 | 5545 | 6173 3 | 6825 | 7416 7 | 7691 7 | 7950 | 8180 | 8430 | 8675 |
| 2430 | 2815 | 3140 | 4300 | 5582 5 | 6175 | 6840 | 7425 | 7700 | 7941 7 | 8183 3 | 8431 3 | 8680 |
| 2436 | 2825 | 3145 | 4330 | 5587 5 | 6185 | 6850 | 7433 3 | 7706 6 | 7950 | 8190 | 8440 | 8683 3 |
| 2440 | 2830 | 3150 | 4340 | 5645 | 6200 | 6875 3 | 7440 | 7706 3 | 7956 3 | 8191 7 | 8441 7 | 8690 |
| 2442 | 2835 | 3190 | 4395 | 5660 | 6206 6 | 6875 | 7441 7 | 7710 | 7960 | 8200 | 8450 | 8691 7 |
| 2300 | 2840 | 3160 | 4391 5 | 5675 | 6225 | 6900 | 7450 | 7716 7 | 7966 7 | 8206 6 | 8458 3 | 8700 |
| 2455 | 2845 | 3165 | 4445 | 5687 5 | 6235 | 6906 6 | 7458 3 | 7720 | 7970 | 8208 3 | 8460 | 8706 6 |
| 2460 | 2850 | 3170 | 4450 | 5700 | 6240 | 6925 | 7466 7 | 7725 | 7973 3 | 8210 | 8466 7 | 8708 3 |
| 2465 | 2855 | 3175 | 4490 | 5706 7 | 6250 | 6940 | 7473 3 | 7730 | 7975 | 8216 7 | 8470 | 8710 |
| 2470 | 2860 | 3200 | 4495 | 5725 | 6273 3 | 6950 | 7475 | 7733 3 | 7980 | 8220 | 8473 3 | 8716 7 |
| 2475 | 2865 | 3202 | 4535 | 5730 | 6275 5 | 6973 3 | 7483 3 | 7740 | 7983 3 | 8225 | 8475 | 8720 |
| 2480 | 2870 | 3205 | 4540 | 5740 | 6275 | 6975 | 7491 7 | 7741 7 | 7990 | 8230 | 8480 | 8725 |
| 2485 | 2875 | 3210 | 4580 | 5750 | 6300 | 7000 | 7500 | 7750 | 7991 7 | 8233 3 | 8483 3 | 8730 |
| 2490 | 2880 | 3230 | 4610 | 5780 | 6306 6 | 7006 6 | 7506 6 | 7756 3 | 8000 | 8240 | 8490 | 8733 3 |
| 2495 | 2885 | 3225 | 4630 | 5773 3 | 6315 | 7025 | 7508 3 | 7760 | 8006 6 | 8241 7 | 8491 7 | 8740 |
| 2505 | 2890 | 3230 | 4635 | 5775 | 6325 | 7040 | 7510 | 7766 7 | 8008 3 | 8250 | 8500 | 8741 7 |
| 2510 | 2895 | 3230 | 4680 | 5780 | 6335 | 7050 | 7516 7 | 7770 | 8010 | 8258 3 | 8506 6 | 8750 |
| 2515 | | | | | | | | | | | | |

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DEALERS! Now you can sell those "dim-out" trade-ins at a good profit.

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PROVEN — TIME TESTED! Tubes rejuvenated experimentally over three years ago are still showing good pictures.

COMPARE THESE FEATURES

- Restores cathode emission and brightness.
- No guesswork — only device that meters cathode activity during rejuvenation. Tells you when to stop rejuvenation to prevent damage to cathode emitting surface. Built-in current limiter prevents accidental cathode ribbon burn-outs!
- Complete tester — detects open or shorted elements and leakage as high as 3 megohms between elements. High quality lab instrument style construction.
- Has special metered circuit to remove "particle" shorts between heater and cathode.
- Checks cathode emission and grid cut-off characteristics.
- Predicts approximate life expectancy of tube — identifies gassy tubes.

TESTS — REPAIRS TV PICTURE TUBES WITHOUT REMOVING TUBE FROM SET



*PATENT PENDING

Condensed Instructions Printed Inside Case Lid



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the signal generator; and alignment procedures for the i.f. amplifier and front end. These films are available from the publisher's Text-Film Department.

Suitable as both a classroom text and a home-study guide, this book meets the need for a hard-hitting and practical manual on radio servicing.

* * *

**"TELEVISION PROGRAM PRODUCTION"** by Carroll O'Meara. Published by *The Ronald Press Company*, New York. 349 pages. Price $5.00.

Those interested in the programming end of the television business will find this compact manual a veritable treasure-trove of pre-tested "know-how" prepared by one of the "old timers" in commercial telecasting.

Based on the author's 8-year experience which included the direction of more than 2000 telecasts, the material has been given a practical, down-to-earth treatment.

The book covers such important aspects of programming as camera operation and control, the use of graphic materials, program settings and costuming, lighting, production of various types of program material, script requirements, the duties of the various members of the station staff, and TV recording on kinescope and tape, and finally, color TV.

The text material is well illustrated with photographs and line drawings and lavish use has been made of actual examples of scripts and script notations. Since in a relatively brief book the author has managed to pack an amazing amount of pertinent data, it behooves those interested in the field to get acquainted with this text.

* * *

**"LICENSE MANUAL FOR RADIO OPERATORS: A GUIDE TO FCC EXAMINATIONS"** by J. Richard Johnson. Published by *Rinehart & Company, Inc.*, New York. 393 pages. Price $5.00.

Those seeking their commercial licenses will welcome the appearance of this clear, concise, and up-to-date study guide. Keyed to the FCC's "Study Guide", the material in this book is arranged in the same order to facilitate preparation for the examinations.

The answers are given in abbreviated form yet are entirely consistent with the FCC examination practices. The introduction outlines the various elements required for each type of examination so that the prospective licensee need study only that material which is pertinent to his examination.

There are five comprehensive appendixes which the student will find valuable. One gives a student's or instructor's subject outline for study purposes, a second covers information about treaties, laws, and regulations and source references for questions relating to laws, a third covers the "Q" signals, while the fourth and fifth deal with common communications abbreviations and the CAA Mercator correction table.

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**Dept. Y-2E, Radio Corporation of America**
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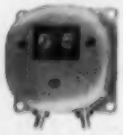
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commercial licenses the student is advised to use only the most up-to-date reference material to insure that his study program is in line with current examination practices. This new book performs this task admirably and should find a wide acceptance among would-be operators.

* * *

**"BASIC ELECTRONICS"** by Van Valkenburgh, Nooger & Neville, Inc. Published by *John F. Rider Publisher, Inc.*, New York. Five volumes. Price $9.00. Paper bound.

This course is based on the training programs currently being offered in the U. S. Navy specialty schools and released for civilian usage. This particular phase of the training pre-supposes a working knowledge of basic electricity. Other than that, there are no prerequisites for tackling this material.

The first volume contains introductory material, discusses diodes, dry metal rectifiers, power supplies, filters and voltage regulators. The second volume takes up amplifiers, triodes, tetrodes and pentodes, audio voltage and power amplifiers, while the third volume covers video amplifiers, r.f. amplifiers, and oscillators. The fourth and fifth volumes cover transmitters, transmission lines and antennas, c.w. transmission and amplitude modulation; receiver antennas, detectors and mixers, t.r.f. receivers and superheterodyne receivers.

This course would be an excellent one for home-study purposes since the text material is clearly written in non-technical terms and the illustrative material is presented in a style that contributes greatly to the clarity. Small cartoon-type characters are used throughout the text to call attention to special circuit features or important points. —30—

## ELECTRONICS AT A-TEST

**AS AN AID to the electronics industry and the Civil Defense Administration in evaluating the effects of nuclear explosions on typical civilian communications equipment, twenty-nine manufacturers of electronic equipment and parts, under the sponsorship of the Radio-Electronics-Television Manufacturers Association participated in the atomic tests held in Nevada recently.**

**The equipment and parts were exposed to nuclear detonation and will be examined later to determine the post-disaster repair problems that will face communications personnel. The information will be made available to the industry and civil defense personnel not only within the FCDA but also at the state and local levels.**

**The following firms participated in the FCDA project under RETMA sponsorship: Admiral, Amphenol, Andrew, Antenna Specialists, Belden, Bendix, Cook Electric, Corning, Dale Products, DuKane, Erie Resistor, General Electric, Hallicrafters, Hughes Aircraft, Hydro-Aire, I.D.E.A., JFD, Jefferson Electric, Lenz Electric, Mallory, Motorola, North Electric, Permoflux, Radio Corporation of America, Remler, Shure Brothers, Simpson, Speer Carbon, and Stainless, Inc.** —30—

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6. Transformer lead color-coding is indicated on the schematic.
7. Transformer winding resistances appear on the schematic.
8. Schematics are keyed to photos and parts lists.

#### FULL PHOTOGRAPHIC COVERAGE

9. Exclusive photo coverage of all chassis views is provided for each receiver.
10. All parts are numbered and keyed to the schematic and parts lists.
11. Photo coverage provides quicker parts identifications and location.

#### ALIGNMENT INSTRUCTIONS

12. Complete, detailed alignment data is standard and uniformly presented in all Folders.
13. Alignment frequencies are shown on radio photos adjacent to adjustment number—adjustments are keyed to schematic and photos.

#### TUBE PLACEMENT CHARTS

14. Top and bottom views are shown. Top view is positioned as chassis would be viewed from back of cabinet.
15. Blank pin or locating key on each tube is shown on placement chart.
16. Tube charts include fuse location for quick service reference.

#### TUBE FAILURE CHECK CHARTS

17. Shows common trouble symptoms and indicates tubes generally responsible for such troubles.
18. Series filament strings are schematically presented for quick reference.

#### COMPLETE PARTS LISTS

19. A complete and detailed parts list is given for each receiver.
20. Proper replacement parts are listed, together with installation notes where required.
21. All parts are keyed to the photos and schematics for quick reference.

#### FIELD SERVICE NOTES

22. Each Folder includes time-saving tips for servicing in the customer's home.
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# FINANCING YOUR BUSINESS

By **DAVID SEILER***

*Service dealers, parts jobbers, and TV retailers may find this method of financing suited to their needs.*

THERE'S big competition opening up nearby; you have several thousand dollars outstanding in unpaid bills; there's been trouble in the shipping of your merchandise; and you wonder what to do next. Money troubles are piling up, and, while there is nothing seriously wrong with your business, you do see yourself facing an emergency—a shortage of ready cash. You may be an expert in the repair, servicing, or selling of electronic equipment, but when it comes to money and credit, you've got to go out and seek some good, sound advice.

Perhaps you are currently facing a somewhat different kind of money problem. Maybe you have a chance to buy out the inventory of a nearby firm going out of business. You know you could successfully complete the deal if only you knew where you could get hold of some ready cash. Or then again, perhaps, like the legendary ant, you are anxious to plan ahead to the slow season in and around July, when you know it will be difficult for you to pay up all your bills and still get all the merchandise you need.

In any such situation, you'll soon discover that the most costly money is the money you don't have when you need it, and, although money problems are universal, your problem is distinctly *yours*, and has to be solved in relation to your particular circumstances. Perhaps you are up in Maine and have very little competition to worry about, or perhaps you are located in Cincinnati, and face severe competition. You may be both a retailer and wholesaler. Maybe the quality of your work and the service you give is superior to that given by others. With your special problem in mind, your particular needs in view, a satisfactory solution can be devised.

There are all kinds of ways of letting money work for you; one way is to use solutions available through any of the more progressive commercial financing companies. Like any other field, there are some commercial financing companies which are more progressive than others.

Referring back to the case of the service dealer who wanted to buy the inventory of a firm going out of business, he got the funds necessary by giving a commercial financing company his receivables and inventory as collateral. Thus, he was able to buy out his competitor. In the case of the dealer who looked ahead, a revolving loan arrangement was set up so that when he needed the money during his slow season, it would be available to him. The excellent factor about this type of planning is that while you will owe a little at the time you borrow the money, and then use it later, you will be only paying for what you actually use, when you use it.

Now you may ask, where does this commercial financing business come in? If I am in temporary need of some extra money, why couldn't a bank help me out just as well? The answer to that question is that banks can help you out with your financial problems—dependent upon your particular situation.

If you are in need of a fairly small amount of money, in a lump sum, for a limited period of time, a bank will suit your needs very well. However, you may be in need of a larger sum of money than a bank would be inclined to give you. Also, when you do borrow from a bank, you borrow the money all in a lump sum, and therefore have to pay interest for a period of time on that amount. But, with a commercial financing company, you borrow only what you need, when you need it.

For instance, perhaps $1000 a month for a period of six months may be all you need. In that case, all you borrow is $1000 a month for which you are charged on a daily basis, and you don't have to worry about clearing up your loan once a year, as a bank would have you do. Also worth noting is that a bank's bookkeeping system is not set up to handle accounts on a daily basis. A commercial financing company determines its rates according to the amount of money in use, plus the amount of money needed to operate the business profitably. Just like a bank, a commercial financing company makes a complete financial appraisal, and if they can help will do so, otherwise, they will make other recommendations.

An electronics jobber, selling from manufacturer to retailer, must necessarily carry a large inventory. To assist him in this, the jobber can obtain extra money when a financing company advances him money against his accounts receivable and inventory. A setup can be arranged whereby money will be advanced on both ends, retail and wholesale. Here again, each situation is different, although they all have the same basic needs. Some ventures look risky, but, after thorough investigation, prove to be perfectly safe. It is solely up to the commercial financing company to decide if a project is worthwhile. They know their business, but it is only until they look at a specific problem that they will go ahead and formulate a plan to solve it.

Large loans are given so that wholesalers can stock a complete line, and

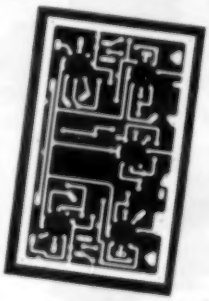
* President, A. J. Armstrong Co., Inc., New York, commercial financing and factoring.

NEW 1955

# Heathkit Engineering Features

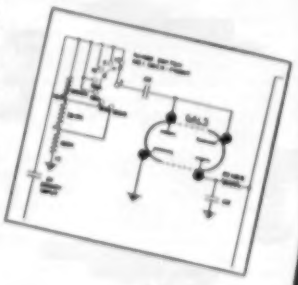
## *New* PRINTED CIRCUITS

One of the many tremendous improvements in the new 1955 Heathkits is the use of an etched metal process printed circuit board. Printed circuits will be used in Heathkits whenever they will affect construction simplification, performance stabilization, and lend themselves to instrument design. Now for the *first* time a kit instrument company offers the advantages of modern printed circuit instrument construction technique. For the *first* time consideration has been given toward reducing kit assembly time. Also this is the *first* time that printed circuit boards have been hand soldered on a volume basis. Offered only by Heathkit, the pioneer and leader in kit instrument design.



## *New* PEAK-TO-PEAK VTVM CIRCUIT

New 6AL5 full wave rectifier in AC input circuit permits full scale peak-to-peak measurements. Seven ranges — upper limits 4000 volts peak-to-peak. Just the thing you TV servicemen have needed in making TV circuit voltage checks. Precision resistor voltage divider limits AC RMS level to 150 volts. Prevents overloading the rectifier—extends upper limit AC RMS ranges to 1500 volts—further protects meter and circuitry against AC flash-over or arcing. Another definite example of continuing Heathkit design leadership in the kit instrument field.




## *New* HIGH READABILITY PANELS

New 1955 Heathkits feature complete panel redesign. Sharp white lettering applied to the beautiful charcoal gray panels, provide a new high in readability. Lettering is easy-to-read open style and panel calibrations are vividly clear against the pleasing soft gray background. New knobs of exclusive Heathkit design.



## *New* 3" UTILITY SCOPE

The new 3" Scope is a "natural" for the well rounded line of Heathkit instruments. Small in size, 11¾" deep, 6½" wide, 9½" high, yet big in performance. Just think of the value an Oscilloscope for $29.50. Brilliant intensity, sharp focusing, wide positioning range. An ideal portable Scope for the TV serviceman—a second shop scope—modulation monitor for you hams (deflection plate terminals in rear of cabinet). Performance to spare for all general scope applications. See specifications on following page.



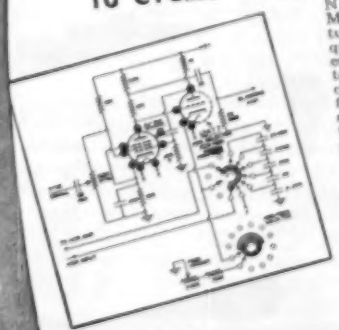
## *New* STYLING *New* COLOR

New styling and coloring is responsible for tremendous improvement in Heathkit appearance. The new instrument panel color combination is high definition white lettering in a soft charcoal gray panel. Cabinet color is a lighter feather gray. The satin gold baked enamel cabinet for the WA-P2 Preamplifier is further indicative of the modern pacesetting trend in Heathkit styling.



## *New* SCOPE SWEEP CIRCUIT 10 CYCLES — 500 KC

New 1955 Heathkit Model O-10 Scope features a new wide frequency range sweep generator covering 10 cycles to 500,000 cycles. This coverage is available in five virtually decading sweep ranges and is five times greater than the sweep frequency range usually available. Excellent retrace time characteristics, actually less than 20% at 500 KC. Use of the free running Heath circuit provides a larger margin of stability and a new high in Heathkit Scope performance.



## *Continuing* PROGRESS FUTURE LINE EXPANSION



The outstanding improvements featured in the 1955 Heathkit line are representative of the progress characterized by Heath Company operation. Long range planning will provide a continuing succession of new kit releases to further expand the Heathkit line which already represents the world's greatest selection of electronic kits. The innovations in the 1955 line, are representative of additional new models scheduled for release for the coming years.

**SEE THE INSTRUMENTS ON THE FOLLOWING PAGES**

**HEATH COMPANY • • Benton Harbor 15, Mich.**

# Heathkit ELECTRONIC SWITCH KIT

Tube complement: 1—6SL7, 1—6X5, 1—6SN7.

Continuously variable switching rates in three ranges from less than 10 CPS to over 2000 CPS.



Individual input gain controls, position control, coarse frequency control, and fine frequency control.

Transformer operated for safety when used in conjunction with other equipment.

MODEL S-2

$23.50

Shpg. Wt. 8 lbs.

**The basic function of the Heathkit Electronic Switch Kit is to permit simultaneous oscilloscope observation of two separate traces which can be either separated or superimposed for individual study. This is accomplished through the use of two individually controlled inputs working through amplifier, multivibrator, and blocking stages. The output of the Electronic Switch is connected directly to the vertical input of the Oscilloscope. A typical example of usefulness would be simultaneous observation of a signal or waveform as it appears at both the input and output stages of an amplifier.**

**APPLICATIONS**

**An Electronic Switch has many applications to increase the over-all operating versatility of your oscilloscope. It can be used to check amplifier distortion—audio crossover networks—phase inverter circuits—to measure phase shift—special waveform study, etc. The instrument can also be conveniently used as a square wave generator over the range of switching frequencies, often providing the necessary wave form response information without incurring the expense of an additional instrument. Ownership of this instrument will reveal many entirely new fields of oscilloscope application and will quickly justify the modest cost of the Electronic Switch Kit.**

# Heathkit VOLTAGE CALIBRATOR KIT



MODEL VC-2

$11.50

Shpg. Wt. 4 lbs.

**Another useful oscilloscope accessory particularly in circuit development work and in TV and radio service work. The Voltage Calibrator provides a convenient method for making peak-to-peak voltage measurements with an oscilloscope, by establishing a relationship on a comparison basis between the amplitude of an unknown wave shape and a known output of the voltage calibrator. Peak-to-peak voltage values are read directly from a calibrated panel scale without recourse to involved calculations.**

**FEATURES:**
**To off-set line voltage supply irregularities, the instrument features a voltage regulator tube. A convenient "signal" position on the panel switch by-passes the calibrator completely and the signal is applied through the oscilloscope vertical input, thereby eliminating the necessity for constantly transferring test leads.**

**RANGES:**
**With the Heathkit Voltage Calibrator it is possible to measure all types of complex waveforms within a voltage range of .01 to 100 volts peak-to-peak. Build this instrument in a few hours and enjoy the added benefits offered only through combination use of test equipment.**

# Heathkit LOW CAPACITY PROBE KIT



No. 342

$3.50

Shpg. Wt. 1 lb.

**An oscilloscope accessory, the 342 Low Capacity Probe permits observation of complex TV waveforms without distortion. An adjustable trimmer provides proper matching to any conventional scope input circuit. Excellent for high frequency, high impedance, or broad bandwidth circuits. The attenuation ratio can be varied to meet individual requirements.**

# Heathkit SCOPE DEMODULATOR PROBE KIT



No. 337-C

$3.50

Shpg. Wt. 1 lb.

**Extend the usefulness of your oscilloscope by observing modulation envelopes of RF or IF carriers found in TV and radio receivers. The Heathkit Demodulator Probe will be helpful in alignment work, as a gain analyzer and a signal tracer. Easy construction with the new modern printed circuit board. Voltage limits are 30 volts RMS and 500 volts D.C.**

# HEATH company

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BENTON HARBOR 15, MICHIGAN


so that they will be in a position to compete in this perhaps most competitive of all fields. In the radio and television business, where competition is sharp, good financial planning is indispensable if you want to stay ahead of your competitors. In certain areas where there are large service companies that do service work on contracts, financing is arranged on those actual service contracts.

In any case, if you need any help at all, you can always get sound financial advice without charge from reliable financing concerns. Be prepared, however, for thorough questioning. The questions will be something like how much money do you have, how much do you need, what has been your experience and study in your line of work, what type of work you do, how expert you are at it, how many people you employ, how large is your business, what kind of service you give, your credit standing, etc. With the money advanced to you, you can buy in carload lots, take advantage of discounts, and be able to make on-the-spot advance purchases.

Here is a typical case history from our files on one sales and service dealer, let's call him "Mr. X." Mr. X had six employes, two of them inside men. He, like many others after the war, opened a place on Long Island, selecting a town in the very heart of this booming industrial and residential area. Although the town tripled in size, he had rough sledding because competition couldn't have been fiercer. Mr. X sought to meet his ever-increasing competition by giving better, quicker service, and by expanding his facilities. He made a move to a larger, higher rent location, close to a major artery of transportation. In his case, however, it was *after* the move was made that he found out, to his dismay, that he had overestimated his resources, and that he was in difficulties moneywise. However, thanks to outside "investments" he was able to pull through and meet competition.

Mr. X had an annual business volume amounting to $250,000, and the net worth of the firm was $25,000. But as a result of his move to his newer and larger location, necessitating the expansion of his entire staff, etc., the service dealer found that he had temporarily depleted his working capital position due to his increased investment in fixed assets.

Help could not be obtained from a bank, but after checking thoroughly, a commercial financing company not only provided the necessary money, but aided in the formation of constructive, long-range financing plans, helping to establish the firm on a sound enough financial basis so that, if necessary, a bank would be willing to continue the financing.

The specific treatment decided upon for Mr. X was accounts receivable financing, advanced on the service charge accounts, plus a revolving inventory financing plan. The results of this financial aid showed themselves

NEW *Heathkit*
5" PUSH-PULL

# OSCILLOSCOPE KIT

FOR COLOR TV

First color television service Oscilloscope with necessary high sensitivity and full 5 megacycle bandwidth.

New 5UP1 CR tube

New printed circuit construction, all components mounted on high insulation surface resulting in uniformly low circuit capacities.

New type wide frequency range Heath sweep generator, 10 cycles to 500,000 cycles.

New cabinet styling and color harmony—charcoal gray—charcoal high panel with readability white lettering.

New electronic positioning controls for instantaneous, definite positioning without bounce or overshoot.



**BRAND NEW DESIGN:** The new Heathkit Model O-10 Oscilloscope would be something special at any price, but is almost unbelievable at $69.50. Completely re-designed scope has broadband amplifiers for color TV work and offers brilliant overall performance. Vertical frequency response within 5 db from 5 cps to 5 mc. Even more astounding, the response is down less than 1½ db at 3.58 mc. the color TV sync burst frequency. It is essential that scopes for color work have these broadband characteristics.

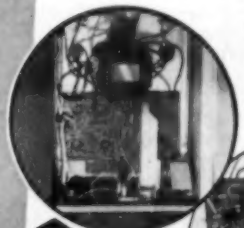
**PRINTED CIRCUITS:** Two printed circuit boards used in this fine instrument to insure stable, consistent performance. Problems solved by pre-engineering of boards, and their use guarantees completed unit that will have same characteristics as lab development model. Printed circuits simplify construction and save labor.

**NEW SWEEP CIRCUIT:** Sweep circuit operates with exceptionally good linearity from 20 cps to over 500,000 cps, 5 times the usual range for scopes in this price range. An entirely new circuit introduced for the first time in any Heathkit.

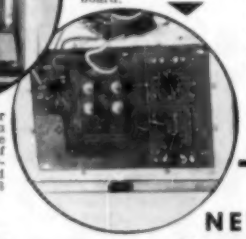
MODEL O-10

**$69.50**

Shpg. Wt. 27 lbs.



Simplified, standardized construction technique of vertical and horizontal amplifier construction made possible through the use of a single *printed circuit* board.



Clean, open, under chassis construction and wiring. Possible only through use of pre-cabled wiring harness, and simplified printed circuit boards.

**FEATURES:** Other outstanding characteristics of this professional oscilloscope are: Built-in 1V peak-to-peak reference for calibration of plastic CRT face-plate; 5" 5UP1 CRT; push-pull hor. and vert. deflection amplifiers; hor. trace width expandable to 3 times diameter of CR tube to allow inspection of any small portion of the signal; deflection sensitivity, .025 volts per inch; wiring harness pre-formed and cabled to save construction time and insure professional appearance and operation. Incorporates efficient retrace blanking. Frequency compensated step attenuator at the vertical input. Entire tube face useable. No foldover on vertical over-load. Performance obtainable only in much more expensive laboratory models.

Uses 5UP1, 6AB4, 6BO7, 12BH7, 6CB6, 12AT7, 2-12AU7, 6X4, 1V2, and 6C4. Quality components used throughout so that outstanding performance characteristics may be maintained for years to come. Plastic molded condensers are used in all coupling and by-pass applications. The "new-look" in Heathkit styling produces professional appearance in keeping with the professional performance of this instrument.

NEW *Heathkit*
3" PRINTED CIRCUIT

## OSCILLOSCOPE KIT

MODEL OL-1

**$29.50** Shpg. Wt. 15 lbs.




3GP1 CR TUBE

New compact utility Scope—lightweight—portable for service work.

Deflection plate terminals—ideal for ham transmitter modulation monitoring.

New easy-to-build printed circuit board with high insulation factor.

New Heathkit instrument styling—charcoal gray panel with high readability white lettering.

New Heath twin triode sweep generator 15–100,000 cycle sweep.

**EXCEPTIONAL VALUE:** The brand new Model OL-1 Utility Oscilloscope is designed especially for portable applications so that outside servicemen or persons performing field tests can have the advantages of a scope available. Then too, it is ideal for home workshop, the ham-shack, or as an "extra" scope for the service shop. It is compact, Lght in weight, and surprisingly versatile in operation. An outstanding instrument for the price.

Front panel controls are "bench-tested" for ease of operation and convenience. Printed circuit board used for constant circuit performance. Assembly time cut in half!

**SPECIFICATIONS:** Vertical amplifiers feature frequency response within 1 db from 10 cps to 100 kc, and within 5 db from 5 cps to 500 kc. Vertical sensitivity .2 volts per inch at 1 kc, with input impedance of 12 mmfd shunting 10 megohms.

Horizontal response within 1 db from 10 cps to 200 kc, and within 5 db from 5 cps to 500 kc. Hor. sensitivity .25 volts per inch at 1 kc, input impedance of 15 mmfd shunting 10 megohms. Sweep generator covers 10 cps to 100,000 cps with stable positive lock-in circuit. Cathode follower input in both vert. and hor. amplifiers; push-pull vertical and horizontal deflection amplifiers; 3" CRT; electronic positioning controls for wide range of vertical and horizontal spot deflection; provision for internal and external sync; 60 cycle line sweep. New modern color styling and unusual performance make this instrument an outstanding value.

NEW *Heathkit*
5" PRINTED CIRCUIT

## OSCILLOSCOPE KIT

MODEL OM-1

**$49.50** Shpg. Wt. 24 lbs.

5BP1 CR TUBE



**VERSATILE INSTRUMENT:** The new Model OM-1 general purpose Oscilloscope represents an outstanding dollar value in reliable test equipment. Full 5 inch CRT. Printed circuit boards for ease of assembly, constant circuit characteristics, and rugged component mounting. Includes all the design features necessary for servicemen, students, experimenters, radio amateurs, etc. Frequency response of amplifiers flat within 1 db from 10 cps to 100 kc, and down only 7 db from 10 cps to 500 kc. Sweep generator range from 20 cps to 100,000 cps. Also features new Heathkit color styling with charcoal gray panel and high definition white lettering for readability even under subdued lighting conditions.

**DESIGN FEATURES:** A full-size, versatile oscilloscope at a price you can afford. Other features are: adjustable spot shape control; RF connections to deflection plates; direct coupled centering controls; external and internal sweep and sync; 60 cycle line sync; built in 1 volt peak-to-peak panel terminal reference voltage; professional appearance of cabinet, panel, and knob styling.

**HEATH company**
A SUBSIDIARY OF DAYSTROM, INC.
BENTON HARBOR 15, MICHIGAN

# Heathkit MULTIMETER KIT

20,000 ohms per volt sensitivity DC. 5,000 ohms per volt AC.

Polarity reversal switch eliminates transferring of test leads.



All 1% precision multiplier resistors—sensitive 50 microamp 4½" Simpson meter.

Total of 35 meter ranges on two color scale.

New modern cabinet styling—attractive appearance.

The new Heathkit Multimeter is a "must" to complete the instrument lineup of any well equipped service shop. Here is an instrument packed with every desirable service feature, many of which are not found in other Multimeters. All of the measurement ranges you need or want. High sensitivity 20,000 ohms per volt DC; 5,000 ohms per volt AC.

MODEL MM-1

**$29.50**

Shpg. Wt. 6 lbs.

★ **ADVANTAGES**

Complete portability through freedom from AC line power operation—provides service ranges of direct current measurements from 150 microamps up to 15 amperes—can be safely operated in RF fields without impairing accuracy of measurement.

★ **RANGES**

Full scale AC and DC voltage ranges are 0–1.5, 5, 50, 150, 500, 1500 and 5,000 volts. Direct current ranges are 150 microamps, 15, 150 and 500 milliamperes and 15 amperes. Resistances are measured from .2 ohms to 20 megohms in 3 ranges and db range from —10 to +65 db.

★ **CONSTRUCTION**

The Heathkit MM-1 features a unique resistor ring switch mounting assembly procedure. With this method of assembly the precision resistors are wired to the rings and range switch before actual mounting of the switch to the instrument panel. This procedure affords the advantage of simpler construction yet complete accessibility of precision resistors in event replacement is ever required. Ohmmeter batteries were selected for convenience of replacement and only standard commercially available types are used. Batteries consist of 1 type C flashlight cell and 4 Penlite cells. All batteries and necessary test leads are furnished with the kit.

## Heathkit HANDITESTER KIT



MODEL M-1

**$14.50**

Shpg. Wt. 3 lbs.

The Heathkit Model M-1 Handitester readily fulfills major requirements for a compact, portable volt-ohm milliammeter. The small size of the smooth gleaming molded bakelite case permits the instrument to be tucked into your coat pocket, toolbox or glove compartment of your car. Always the "Handitester" for those simple repair jobs.

**RANGES:**

Despite its compact size, the Handitester is packed with every desirable feature required in an instrument of this type. AC or DC voltage ranges, full scale, 10, 30, 300, 1,000 and 5,000 volts. 2 convenient ohmmeter ranges 0–3,000 ohms and 0–300,000 ohms. 2 DC milliammeter ranges 0–10 milliamperes and 0–100 milliamperes.

**CONSTRUCTION**

The instrument uses a 400 microampere meter movement which is shunted with resistors to provide a uniform 1 milliampere load in both AC and DC ranges. This design allows the use of but 1 set of 1% precision divider resistors on both AC and DC and provides a simplicity of switching. A small hearing aid type ohms adjust control provides the necessary zero adjust function on the ohmmeter range. The AC rectifier circuit uses a high quality Bradley rectifier and a dual half wave hookup. Necessary test leads and battery are included in the price of this popular kit.

## Heathkit RESISTANCE SUBSTITUTION BOX KIT

MODEL RS-1

**$5.50**



36 standard RTMA 1 watt resistor values between 15 ohms and 10 megohms with an accuracy of 10% are at your fingertips in the Model RS-1 Resistance Substitution Box kit. This sturdy and attractive accessory will easily prove its worth many times over as a time saving device. Order several today.

Shpg. Wt. 2 lbs.

## Heathkit CONDENSER SUBSTITUTION BOX KIT

MODEL CS-1



**$5.50**

18 standard RTMA values are available from .0001 mfd to .22 mfd. An 18 position switch set in the panel of an attractive bakelite case allows quick changes without touching the test leads. Invest a few minutes of your time now and save hours of work later on.

Shpg. Wt. 2 lbs.

**HEATH company**

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 15, MICHIGAN


quickly. There was an increase in net worth by profits resulting from the increased business, due to the better service offered by Mr. X and his trained staff, and due also to his more convenient location. Good financial standing was regained, and the expansion of the business accomplished as well. From that time forward, regular bank financing would be no problem to arrange.

Located mainly in New York, but transacting business all over the United States, commercial financing companies operate their businesses somewhat differently than you might expect. When a dealer is no longer in need of financial help, or wishes a bank to carry on the financing, then the financing company bids them farewell, happy to have been of help. In any case, the dealer only pays for what money he uses, when he uses it. The fact that the dealer only pays interest on a day-to-day basis for only the number of days the funds are outstanding, makes the difference in interest between that charged by a bank and that of a commercial financing company quite small. In most cases, the discount that the account is able to earn by prompt payment of bills far exceeds the total charge, which is a tax-deductible expense.

There are many solid results to be obtained through commercial financing, with the end result of a substantial, steady increase in profits. Somewhat like a doctor, a commercial financing company will diagnose the "symptoms", prescribe the needed medicine (in this case, the actual financial aid), and give freely of advice and knowledge gained from long years of experience in the financial world. Then, when the "patient" returns to a healthy business condition, they will quietly step out of the picture. In a business characterized by constant, fierce competition, the ability to get ready money often spells out the difference between success and failure. Or, as someone else once put it, "Opportunity favors the prepared man." —30—

### Transistor Preamp

(*Continued from page* 39)

plifier in the basement or attic if you so choose.

If tone controls are your problem, then add them after the preamp, and tack on another transistor stage . . . maybe a grounded collector this time, so you can have a higher impedance input, with still a low Z output.

Just keep the soldering iron off those little wire pigtails. Don't count on a pair of pliers pinching the lead to draw off the heat. Heed the voice of sad experience, and use sockets of the store-bought or home-made variety.

Remember, we can help those little wonders to come down in price and up in variety, if we put them to just a few of the untold thousands of uses of which they are capable. —30—

# NEW Heathkit VACUUM TUBE VOLTMETER KIT

PRINTED CIRCUIT DESIGN



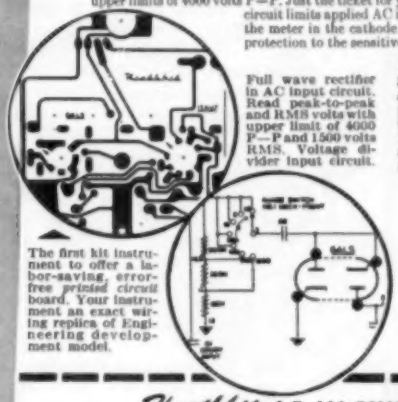
*New* charcoal gray baked enamel panel with high readability, white lettering. New soft feather gray cabinet, subdued pilot light indicator.

*New* printed circuit board for faster, easier construction—exact duplication of Lab development model.

Another outstanding example of continuing Heath Company pioneering and leadership in the kit instrument field. A new **printed circuit** VTVM. New peak-to-peak circuit—new styling and new panel design. A prewired, prefabricated printed circuit board eliminates chassis wiring, cuts assembly time in half, assures duplication of Engineering pilot model specifications, and virtually eliminates possibility of construction error.

**CIRCUIT:**

A 6AL5 tube operated as a full wave AC input rectifier permits seven peak-to-peak voltage ranges with upper limits of 4000 volts P—P. Just the ticket for you TV servicemen. Voltage divider in the 6AL5 input circuit limits applied AC input to a safe level. This circuitry and the isolation of the meter in the cathode of the 12AU7 bridge circuit affords a high degree of protection to the sensitive 200 microampere meter.



Full wave rectifier in AC input circuit. Read peak-to-peak and RMS volts with upper limit of 4000 P—P and 1500 volts RMS. Voltage divider input circuit.

The first kit instrument to offer a labor-saving, error-free *printed circuit* board. Your instrument an exact wiring replica of Engineering development model.

**RANGES:**

Seven voltage ranges, 1.5, 5, 15, 50, 150, 500 and 1,500 volts DC and AC RMS. Peak-to-peak ranges 4, 14, 40, 140, 400, 1400, 4000. Ohmmeter ranges X1, X10, X100, X1000, X10K, X100K, X1 meg. Additional features are a db scale, a center scale zero position, and a polarity reversal switch.

*New* easy-to-read open panel layout. Off-on switch now incorporated in the selector switch.

MODEL V-7

**$24.50**

Shpg. Wt. 7 lbs.

**IMPORTANT FEATURES:**

High impedance 11 megohm input—transformer operated—1% precision resistors, 6AL5 and 12AU7 tube—selenium power rectifier—individual AC and DC calibrations—smoother improved zero adjust control action—new panel styling and color—new placement of pilot light—new positive contact battery mounting—new knobs—test leads included.

The new V-7 also sets the pace as a kit instrument style leader. Smart, good-looking charcoal gray panel and soft feather gray cabinet. High readability panel with sharply contrasting white calibrations. The pleasing, eye catching, modern styling is in harmonious balance with the outstanding circuit design improvements. Easily the best buy in kit instruments.

*New* peak-to-peak meter scale—new color harmony—new knobs.

## Heathkit AC VACUUM TUBE VOLTMETER KIT

MODEL AV-2



**$29.50** Shpg. Wt. 5 lbs.

Extreme sensitivity has been emphasized in the design of the Heathkit AC VTVM. Ten full scale RMS ranges are .01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 volts. Frequency response is substantially flat from 10 cycles per second to 50 KC with input impedance of 1 megohm at 1 KC. Will accurately measure as low as 1 millivolt at high impedance. Total db range is —52 db to +52 db. An excellent kit for measuring the output of phono cartridges and the gain of amplifier stages. Use it also to check power supply ripple, as a sensitive null detector, and for compiling frequency response data. Features one knob operation, 200 microampere Simpson meter and precision resistors.

## Heathkit 30,000 VOLTS DC PROBE KIT

Measure up to 30,000 volts DC with the Heathkit VTVM and the 336 high voltage Probe. Precision resistor provides multiplication factor of 100. Can be used with any 11 megohm input VTVM. Housed in a Polystyrene two color sleek plastic probe body for safety of operation.



No. 336

**$4.50**

Shpg. Wt. 1 lb.

## Heathkit PEAK-TO-PEAK PROBE KIT



No. 338-C

**$5.50**

Shpg. Wt. 2 lbs.

Peak-to-peak values not exceeding 80 volts at a DC level of not more than 600 volts, can now be read directly by using 338-C Probe with previous model Heathkit VTVM's or any VTVM with 11 megohm input resistance. Probe construction features a modern printed circuit board for easy assembly. Frequency range 5 KC to 5 MC.

## Heathkit RF PROBE KIT

The Heathkit RF Probe will permit the measurement of RF voltages up to 250 MC with an accuracy of ±10%. The limits are 30 volts AC and a DC level of 500 volts. Designed for any 11 megohm input VTVM. Modern styling. Polystyrene aluminum housing. Polystyrene insulation, and printed circuit board for easy assembly.



No. 309-C

**$3.50** Shpg. Wt. 1 lb.

## Heathkit AUDIO WATTMETER KIT



Read audio power output directly without using external load resistors with the new Heathkit Audio Wattmeter. Built-in non-inductive load resistors provide impedances of 4, 8, 16, and 600 ohms. Flat response from 10 CPS to 250 KC. Full scale power ranges are 0–5 MW, 0–50 MW, 0–500 MW, 0–5 W and 0–50 W. Model AW-1 will operate continuously at 25 watts and has a duty cycle of 3 minutes at 50 watts. Total db range in five positions is —50 db to +48 db, using the standard 1 milliwatt 600 ohms.

MODEL AW-1

**$29.50**

Shpg. Wt. 6 lbs.

**HEATH company**

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BENTON HARBOR 15, MICHIGAN

*Heathkit* 6-12 VOLT

# BATTERY ELIMINATOR KIT

Automatic overload relay—self resetting—fuse protected.

New 18 plate split type, heavy duty rectifier unit.



Here is the new 12 volt Heathkit Battery Eliminator so necessary for modern up-to-date operation of your Service Shop. Furnishes either 6 or 12 volt output which can be selected at the flick of a panel switch. Use the BE-4 to service all of the new 12 volt car radios in addition to the conventional 6 volt models.

Continuously variable output voltage, either 6 or 12 volt operation.

Constant ammeter and voltmeter monitoring.

MODEL BE-4

$31.50

Shpg. Wt. 17 lbs.

**RANGES:**

This new Battery Eliminator provides two continuously variable output voltage ranges. 0-6 volts D.C. at 10 amperes continuously or 15 amperes maximum intermittent and 0-12 volts D.C. at 5 amperes continuously or 7.5 amperes maximum intermittent. The output voltage is clean and well filtered, as the circuit uses two 10,000 mfd condensers.

The continuously variable voltage output feature is of definite aid in determining the starting point of vibrators, the voltage operating range of oscillator circuits, etc.

**OTHER USES:**

The controllable low voltage DC supply has many other applications besides primary use in car radio service work. Can be nicely used as a battery charger, or low voltage DC supply for electric trains. Has applications in high gain audio work requiring clean DC filament supply. Can be used for low power electro-plating or as a power supply for battery powered intercommunication systems.

*Heathkit*

## VIBRATOR TESTER KIT



MODEL VT-1

$14.50

Shpg. Wt. 6 lbs.

This time-saving device will quickly pay for itself in your auto radio service shop. 6 volt vibrators can be checked instantly on the *Good—Bad* type meter scale. Operation requires only a variable DC voltage from 4 to 6 volts at 4 amperes. Model BE-4 Battery Eliminator is recommended for this application.

Five test sockets provide for the testing of hundreds of interrupter and self-rectifier types. Proper starting voltage is determined easily and accurately. Over-all quality is then unmistakenly indicated on the panel mounted meter.

*Heathkit*

## IMPEDANCE BRIDGE KIT



MODEL IB-2

$59.50 Shpg. Wt. 12 lbs.

The new Heathkit Impedance Bridge features built-in adjustable phase shift oscillator and amplifier. This instrument actually represents four instruments in one compact unit. The Wheatstone bridge for resistance measurements, the Capacity Comparison bridge for capacity measurements, Maxwell bridge for low Q, and Hay bridge for high Q measurements.

**DESIGN:**

Panel provisions for external generator use. A new two section CRL dial, provides ten separate "units." Ten separate units switch settings and fractions of units are read on a continuously variable calibrated control. A special minimum capacity shielded and balanced impedance matching transformer between the generator and bridge circuit is automatically switched to provide correct load operation of the generator circuit. The instrument uses ½% precision resistors and condensers in all measurements circuits.

*Heathkit* VARIABLE VOLTAGE ISOLATION TRANSFORMER KIT



Variable output voltage between 90 and 130 volts AC. Rated at 100 volt—amperes continuously and 200 volt—amperes intermittently. The principle function of the Heathkit Isolation Transformer is to isolate the circuit being tested from line interference being caused by motors, appliances, etc. It works backward too by isolating such devices from the line. Many other uses, especially with AC-DC type circuits. Do not confuse the Heathkit Isolation Transformer with the hazardous auto transformer type line voltage boosters.

MODEL IT-1

$16.50

Shpg. Wt. 10 lbs.

**HEATH company**

A SUBSIDIARY OF DAYSTROM, INC.

BENTON HARBOR 15, MICHIGAN


## Mac's Radio Service Shop

(*Continued from page 74*)

room swings wide open again, I feel good and warm and powerful—more so than I'd feel if someone deposited a thousand dollars in my bank account. And when we return a TV set to a home and the kids swarm all over us in their eagerness to know if they can really see their favorite shoot-em-up programs again, and as I listen to their shouts of glee when they find out they can, I get this feeling all over again. Maybe this makes me sentimental, old-fashioned, and unbusiness-like, but it's nice to know that people *need* and depend on your knowledge and skill to insure their happiness. There's a lot of pretty satisfactory compensation in being able to serve your fellow men."

"How about the magazine articles and newspaper 'exposees' that have tried to brand the servicemen as cheats and crooks?" Barney asked. "Do you think they indicate the way most people feel about servicemen?"

"By no means. There will always be some people who through jealousy or just plain cussedness are suspicious of anyone they feel may know more than they do or work harder. These people think all doctors are quacks, all ministers are hypocrites, all lawyers are crooked, and all radio and TV servicemen charge outrageous prices for stealing tubes and parts and messing up sets. It is futile to argue with these ignorant people, for no one can change the mind of a fool. Fortunately, they are in a very small minority, probably bearing about the same ratio to the general public that crooked servicemen bear to the total number in this field. Recently several manufacturers have gone to bat for us and have used their advertising pages in various popular magazines to tell our true story to the public. We certainly appreciate this, for it helps a lot to counteract the vicious and unfounded attacks made on the service industry. I'm pretty confident folks in this town do not consider me a crook and a thief. If so, they must like being cheated, for they keep coming back for more. I'm still working for customers who started bringing me their sets the first year I was in business."

"Any more good things about servicing you can think of?" Barney asked, glancing casually at the clock.

"Lots of them. For one thing, working conditions here are much better than in many other fields. Contrast our job with that of the auto mechanic who must work on his back in dirt and grease, or with that of the doctor who is likely to be called any hour of the day or night, or with the monotonous work of the assembly line worker who keeps performing the same task over and over again until his brain is numbed with the repetition. A friend of mine who gave up a good job as an electronic engineer with a large corporation to start his own radio and TV

NEW *Heathkit*

# TV ALIGNMENT GENERATOR KIT

Controllable inductor sweep oscillator with output entirely on fundamentals.

Triple marker system 4.5 MC crystal controlled—3 sets of low loss, low capacity shielded cables included.

Electronically operated, smooth continuously variable, sweep circuit. No vibration, hum or noise.



Frequency coverage: 4 MC—220 MC continuous including FM spectrum. RF output well over .1 volt.

**MODEL TS-4**

**$49.50**

SHPG. WT. 16 LBS.

Here is the most radically improved Sweep Generator in the history of the TV service industry. The basic design follows latest high frequency techniques which result in a combination of performance features not found in any other sweep generator.

**SWEEP:**

Sweep action is obtained electronically through the use of a newly developed controllable inductor, thereby eliminating all moving parts with their resultant hum, vibration, fatigue, etc. Frequency coverage entirely on fundamentals, is continuous from 4 MC to 220 MC at an output level well over a measurable .1 volt.



Triple marker system, 4.5 MC crystal controlled marker—continuously variable marker—provisions for external marker.



Automatic amplitude control circuit—constant output voltage regulated power supply.

**MARKER:**

The same instrument incorporates a triple marker system with a crystal controlled reference. A variable marker provides accurate coverage from 19 to 60 MC on fundamentals, and 57 to 180 MC on calibrated harmonics. A separate fixed crystal controlled 4.5 MC marker can be used for checking IF, bandpass, calibration, reference, etc. Provisions are also made for external marker use. A 4.5 MC crystal is supplied with the kit.

**POWER SUPPLY:**

The transformer operated Power Supply features voltage regulation for stable oscillator operation. Three sets of shielded cables are furnished with the kit. Sweep range is completely and smoothly controllable from zero up to a maximum of 42 MC, depending upon base frequency.

Here is a TV Sweep Generator that truly no serviceman can afford to be without for rapid, accurate, TV alignment work.

NEW *Heathkit*

# SIGNAL GENERATOR KIT



**MODEL SG-8**

**$19.50** Shpg. Wt. 8 lbs.

The new Heathkit service type Signal Generator, Model SG-8 incorporates many design features not usually found in this instrument price range. Frequency coverage is from 160 KC to 110 MC in five ranges, all on fundamentals, with useful calibrated harmonics up to 220 MC. The RF output level is well in excess of 100,000 microvolts throughout the frequency range. The oscillator circuit consists of a twin triode tube, one-half used as a Colpitts oscillator, and the other half as a cathode follower output which acts as a buffer between the oscillator and external load, thereby eliminating oscillator frequency shift usually caused by external loading.

All coils are factory wound and adjusted, thereby completely eliminating the need for individual calibration and the use of additional calibrating equipment. The stable, low impedance output, features step and variable attenuation for complete control of RF level. A separate 6C4 triode acts as a 400 cycle sine wave oscillator, and a panel mounted switching system permits choice of either external or internal modulation.

NEW *Heathkit* **BAR GENERATOR KIT**



**MODEL BG-1**

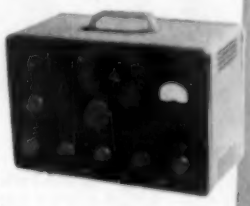
**$14.50** Shpg. Wt. 4 lbs.

The Heathkit BG-1 produces a series of horizontal or vertical bars on a TV screen. Since these bars are equally spaced, they will quickly indicate picture linearity of the receiver under test without waiting for transmitted test patterns. Panel switch provides "standby—horizontal and vertical position." The oscillator unit uses a 12AT7 twin triode for the RF oscillator and video carrier frequencies. A neon relaxation oscillator provides low frequency for vertical linearity tests. The instrument will also provide an indication of horizontal and vertical sync circuit stability as well as overall picture size. Operation is simple and merely requires connection to the TV receiver antenna terminal. Transformer operated for safety.

*Heathkit*

LABORATORY

# GENERATOR KIT



**MODEL LG-1**

**$39.50**

Shpg. Wt. 16 lbs.

The new Heathkit Laboratory type Signal Generator definitely establishes a new performance standard for a kit instrument. An outstanding feature involves the use of a panel mounted 200 microampere meter calibrated both in microvolts and percent modulation, thereby providing a definite reference level for using the Signal Generator in design work, gain measurements, selectivity, frequency response checks.

**DESIGN:**

Additional design features are copper plated shield enclosure for oscillator and buffer stages resulting in effective double shielding. Fibre panel control shaft extensions in RF carrying circuits, thorough AC line filtering, careful shielding of the attenuator network, voltage regulated B plus supply, selenium rectifier, etc.

**RANGES:**

Frequency coverage from 150 KC to 30 MC all on fundamentals in five separate ranges. Output voltage .1 volt with provisions for metered external or internal modulation. Output impedance termination 50 ohms. Transformer operated power supply.

Investigate the many dollar stretching features offered by the LG-1 before investing in any generator for Laboratory or Service work.

**HEATH company**

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BENTON HARBOR 15, MICHIGAN

*Heathkit*
VISUAL-AURAL
# SIGNAL-TRACER KIT




The new Heathkit Visual-Aural Signal Tracer features a special high gain RF input channel used in conjunction with a newly designed wide frequency range demodulator probe. High RF sensitivity permits signal tracing from the receiver antenna input. Separate low gain channel and probe available for audio circuit exploration. Both input channels are constantly monitored by an electron ray beam indicator so that visual as well as aural indications may be obtained.

**NOISE LOCATOR:**
A decidedly unusual feature is a noise locator circuit used in conjunction with the audio probe. With this system, a DC potential is applied to a suspected circuit component and the action of the voltage in the component can be seen as well as heard. Invaluable for ferreting out noisy or intermittent condensers, noisy resistors, controls, IF and power transformers, etc.

MODEL T-3
$23.50
Shpg. Wt. 9 lbs.

**WATTMETER:**
Built-in calibrated wattmeter circuit will prove useful for quick preliminary check of total wattage consumption of equipment under test. Separate panel terminals provide external use of the speaker or output transformer for substitution purposes. Saves valuable service time by eliminating the necessity for speaker removal on every service job. The same panel terminals also provide easy access to a well filtered B plus supply for external use. Don't overlook the many interesting service possibilities provided through the use of this instrument, and let the Signal Tracer work for you by saving time and money.

## *Heathkit* CONDENSER CHECKER KIT



MODEL C-3
$19.50 Shpg. Wt. 7 lbs.

Here is a handy test instrument for any Service Shop. Unknown values of capacity and resistance are quickly determined on the direct reading condenser checker dial. Capacity is measured in four ranges from .001 mfd to 1000 mfd. Resistance in the range from 100 ohms to 5 megohms.

DC polarizing voltages of 25, 150, 250, 350, and 450 volts are available for leakage tests on all types of condensers. For electrolytics, a power factor control is provided to balance out inherent leakage and to indicate directly the power factor of a condenser under test. Proper balancing of the AC bridge is reflected on the degree of closure of an electron beam indicator tube.

Model C-3 uses a transformer operated power supply, spring return leakage test switch, and a convenient combination of panel scales for all readings. Test leads are furnished in addition to precision components for calibrating purposes. Quick and easy to operate, the Heathkit Condenser Checker will save valuable time and increase your Shop efficiency.

## *Heathkit* "Q" METER KIT



MODEL QM-1
$44.50
Shpg. Wt. 14 lbs.

The Heathkit QM-1 represents the first practical popular priced Q meter available within the price range of schools, laboratories, TV service men, and experimenters. This instrument will enable the operator to simulate conditions encountered in practical circuits and to measure the performance of coils or condensers at the operating frequencies actually encountered. All indications of value are read directly on the 4½" 50 microampere Simpson calibrated meter scale. Measures Q of condensers, RF resistance, and the distributed capacity of coils. Oscillator section supplies RF frequencies 150 KC to 18 MC in four ranges. Calibrate capacity with range of 40 MMF to 450 MMF with vernier of ±3 MMF. Investigate the many services this instrument can perform for you.

## *Heathkit* AUDIO OSCILLATOR KIT



MODEL AO-1
$24.50
Shpg. Wt. 10 lbs.

The Heathkit Audio Oscillator will produce both sine and square waves within the frequency range from 20 CPS to 20 KC in three ranges. Thermistor controlled linearity results in a variation of no more than ±1 db in a 10 volt (no load) variable output level. There will be less than .5% distortion from 100 CPS throughout the audible range. Low impedance 600 ohm output. Precision 1% resistors, used in the range multiplier circuits to provide accurate calibration.

**HEATH company**
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BENTON HARBOR 15, MICHIGAN


service business told me recently that doing service work was a lot more challenging and made a much greater demand on *all* the electronic knowledge he acquired in college than did his engineering job of installing microwave relay lines down in South America. He is more than satisfied with his income, his working conditions, and his prospects for the future. He says he cannot understand why more trained engineers do not go directly into servicing.

"Finally, a thing that is much more significant to me than to you at this point is the fact that a serviceman can, if he chooses, have a good long work life. Since physical strength and agility play unimportant parts in servicing, increasing years do not force you to retire, as is the case in many other lines of work. You know my friend, Bill, here in town. Well, I know for certain that he's pushing seventy awful hard, if he's not actually over that hurdle; but he is right in there slinging solder with the best of them.

"Someone has said that nothing is work unless you would rather be doing something else, and in that case a good serviceman does not do any work at all, for he would not trade jobs with anyone from the President of the United States on down. That does not mean he won't growl and gripe about his work, especially when he has had a long run of 'dogs' parading across his service bench; but you separate him from that bench for a few days and he will actually be aching to get hold of a solder gun again. When a lot of fellows feel like that about their job, there can't be too much wrong with it.

"And now," Mac finished with a slow grin as he knocked the ashes from his pipe on the heel of his shoe, "if I've killed enough time to suit you, suppose we go to work." —30—

## "HILLBILLY NET" CARD

**THE Kingsport Amateur Radio Club and the Bays Mountain Radio Club of Kingsport, Tenn. have announced the availability of its new model 1955 "Hillbilly Net Certificate."**

**Rules governing the award of such a certificate are as follows:**

**1. No contacts prior to January 1, 1955 will be counted.**

**2. Contacts must be made with ten different "Hillbilly Net" members—contacts with W4TRC and W4ZJA (the club stations) can be included to make up the ten contacts, regardless of who was operating the station.**

**3. Contacts can be made on any amateur band or combination of bands.**

**4. Application for a certificate can be made through any means of communication and must include callsign of "Hillbilly Net" member and dates of QSO. Application to any member of the "Hillbilly Net" who will forward it to the Net Secretary, W4VUA.**

**5. Certificate will not be mailed until contacts have been verified.**

**6. "Hillbilly Net" member must belong to one of the two sponsoring clubs and must have paid his $1.00 assessment before his contact can be counted.**

**The Certificate is pure "hillbilly" and good for lots of laughs.** —30—

# Heathkit TUBE CHECKER KIT




The Heathkit TC-2 Tube Checker was primarily designed for the convenience of radio and TV servicemen and will check the operating quality of tubes commonly encountered in this type of work. Test set-up procedure is simplified, rapid, and flexible. Panel sockets accommodate 4, 5, 6, and 7 pin tubes, octal and loctal, 7 and 9 pin miniatures, 5 pin Hytron, and a blank socket for new tubes. Built-in neon short indicator, individual 3-position lever switch for each tube element, spring return test switch, 14 filament voltage ranges, and line-set control to compensate for supply voltage variations, all represent features of the TC-2.

Results of tube tests are read directly from the large 4½" Simpson 3-color meter. Checks emission, shorted elements, open elements, and continuity. Wiring procedure has been simplified through the use of multi-wired color coded cable providing a harness type installation between tube sockets and lever switches. This procedure insures standard assembly and imparts a "factory built" appearance to the instrument. New Construction Manual furnishes detailed information regarding tube set-up procedure for testing of new or unlisted tube types. No delay necessary for release of factory data.

MODEL TC-2
**$29.50**
Shpg. Wt. 12 lbs.

## Heathkit PORTABLE TUBE CHECKER KIT



The portable model is supplied with a strikingly attractive two-tone cabinet finished in rich maroon proxylin impregnated fabric covering with a contrasting gray on the inside of the detachable cover.

MODEL TC-2P
**$34.50**
Shpg. Wt. 15 lbs.

## Heathkit REGULATED POWER SUPPLY KIT



MODEL PS-2
**$33.50** Shpg. Wt 15 lbs.

Here is a source of regulated D.C. voltage for circuit development work. Power supply voltage and current drain to the circuit under test are constantly monitored by the 4½" panel mounted meter. Separate 6.3 volt at 4 ampere A.C. filament source available. The regulated and variable output voltage will be constant over wide load variations, and hum ripple will not exceed .012% at 250 volts under a 50 MA load. Completely isolated circuit, standby switch, and other desirable features, make the Model PS-2 extremely useful in a wide variety of applications.

## Heathkit TV PICTURE TUBE TEST ADAPTER



The Heathkit TV Picture Tube Test Adapter used with the Heathkit Tube Checker Kit, will quickly check picture tubes for emission, shorts, etc. and determine tube quality. Consists of standard 12-pin TV tube socket, four feet of cable, octal socket connector, and data sheet.

No. 355
**$4.50** Shpg. Wt. 1 lb.

## Heathkit DECADE RESISTANCE KIT



MODEL DR-1
**$19.50**
Shpg. Wt. 4 lbs.

Twenty 1% resistors are decaded in 1 ohm steps to provide any value between 1 ohm and 99,999 ohms. Sturdy ceramic switches with silver plated contacts insure reliable service. Use the Decade Resistance in bridge circuits, meter multipliers, calibrations, or any application requiring a wide range of precision resistance values.

## Heathkit AUDIO GENERATOR KIT



Here is an Audio Generator with features generally found only in the most expensive instruments. Sine wave coverage from 20 cycles to 1 Megacycle—response flat ±1 db from 20 cycles to 400 Kc—continuously variable and step attenuated output. Because the output voltage is relatively constant over wide frequency ranges, the AG-8 is ideal for running frequency response curves in audio circuits. Once set by means of the attenuator, this voltage may be relied upon for accuracy within ± 1 db. Instrument features low impedance 600 ohm output circuit and distortion less than .4 of 1% from 100 CPS through audible range.

MODEL AG-8
**$29.50**
Shpg. Wt. 11 lbs.

## Heathkit DECADE CONDENSER KIT

The Heathkit Decade Condenser provides a ready source of capacity values from 100 mmf to .111 mfd inclusive in capacity steps of 100 mmf. Silver plated contacts on husky ceramic switches, assure positive contact for each switch position. Precision silver mica condensers ±1% accuracy for close tolerance accurate work.

MODEL DC-1
**$16.50**
Shpg. Wt. 3 lbs.



## HEATH company

A SUBSIDIARY OF DAYSTROM, INC.
BENTON HARBOR 15, MICHIGAN

NEW *Heathkit* HIGH FIDELITY

# PREAMPLIFIER KIT




Here is the exciting new Heathkit Preamplifier with all of the features you Audiophiles have asked for and at a down-to-earth price level. Beautiful satin gold baked enamel finish, striking control knobs and arrangement, attractive custom appearance and entirely functional design.

**DESIGN:**
Uses three twin triode tubes in a shock mounted chassis, 2-12AX7 and 1-12AU7. Features tube shielding, plastic sealed color coded capacitors, smooth acting controls, good filtering, excellent decoupling, low hum and noise level, and all aluminum cabinet. Special balancing control for absolute minimum hum level. Cathode follower, low impedance output circuit for complete installation flexibility.

**SPECIFICATIONS:**
Provides five switch selected inputs, 3 high level, and two low level, each with individual level controls—4 position LP, RIAA, AES, and early 78 equalization switch—4 position roll-off switch, 8, 12, 16 with one flat position. Separate tone controls, bass 18 db boost and 12 db cut at 50 CPS, treble 15 db boost, and 20 db cut at 15,000 CPS. Power requirements from Heathkit Williamson Type Amplifier power supply 6.3 volts AC at 1 ampere, and 300 volts DC at 10 MA. Over-all dimensions 12⅝" wide x 5¼" deep x 3⅝" high.

**APPLICATION:**
The new Heathkit WA-P2 Preamplifier has been designed to operate with any of the Heathkit Williamson Type Amplifiers and is directly interchangeable with the previous Model WA-P1 Preamplifier unit. Order your kit today and enjoy completely smooth control over the operation of your Hi-Fi system. Obtain the exact tonal balance of bass and treble with the precise degree of equalization you want. Note that the design of the WA-P2 accommodates the newly established RIAA curve.

MODEL WA-P2
**$19.75**
Shpg. Wt. 7 lbs.

## HAM EQUIPMENT




*Heathkit*
AMATEUR
## TRANSMITTER KIT

The Heathkit AT-1 Transmitter has established a high reputation and has been enthusiastically accepted by hundreds of experienced operators as well as beginners. Power input up to 35 watts for the novice and suitable as a standby exciter for your higher powered rig later on.

Model AT-1 can be crystal or VFO excited and operates on 80, 40, 20, 15, 11 and 10 meters. The pre-wound coils with the oscillator and amplifier are switched simultaneously by the rugged band switch. Meter switch allows a reading of the final grid and plate current on the panel mounted meter. Modulator input and VFO power sockets are provided as well as a key jack for CW operation. Other features include a crystal socket, standby switch, key click filter, AC line filter, good shielding and a 52 ohm coaxial output. The 425 volt, 100 milliampere power supply and 5U4 rectifier are more than adequate for the 6AG7 oscillator multiplier and 6L6 amplifier doubler.

MODEL AT-1
**$29.50**
Shpg. Wt. 16 lbs.




*Brand* NEW
HEATHKIT
## VFO KIT

The new Heathkit VFO is the perfect companion to the Heathkit Model AT-1 Transmitter and it has sufficient output to drive any multi-stage transmitter of modern design. Good mechanical and electrical design insures operating stability. Coils are wound on stable, heavy duty, ceramic forms using Litz or double cellulose wire coated with Polystyrene cement and baked for humidity protection. Variable capacitor of differential type construction, especially designed for maximum bandspread. Kit is furnished with a carefully precalibrated scale which provides well over two feet of scale length. Smooth acting vernier reduction drive and illuminated dial provides easy tuning and zero beating.

Power requirements 6.3 volts AC at .45 amperes, and 250 volts DC at 15 mils. Just plug it into the power receptacle provided on the rear of the AT-1 Transmitter. Seven band coverage 160 through 10 meters with 10 volt average RF output. Uses 6AU6 electron coupled Clapp oscillator and OA2 voltage regulator.

MODEL VF-1
**$19.50**
Shpg. Wt. 7 lbs.

*Heathkit*
## GRID DIP METER KIT



The invaluable instrument for Hams, servicemen and experimenters. Useful in TV service work, for alignment of traps, filters, IF stages, peaking compensation networks, etc. Locates spurious oscillation, provides a relative indication of power in transmitter stages. Use it for neutralization, locating parasitics, correcting TVI, measuring CL and Q of components, and determining RF circuit resonant frequencies. The variable meter sensitivity control, headphone jack, 500 microampere Simpson meter, continuous frequency coverage from 2 MC to 250 MC. Prewound coil kit and rack included.

**LOW FREQUENCY COILS:**
Low frequency range extended to 355 KC by the use of two additional coils. Complete with dial correlation curves. Set 341-A for GD-1B and set 341 for GD-1A. Shipg. wt. 1 lb. Price $3.00

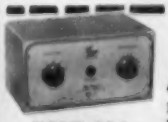
MODEL GD-1B
**$19.50**
Shpg. Wt. 4 lbs.

*Heathkit* ANTENNA
## IMPEDANCE METER KIT



MODEL AM-1
**$14.50**
Shpg. Wt. 2 lbs.

Determine antenna resonance and resistance, transmission line surge impedance, and receiver input impedance. Works with one-half and one-quarter wave lines, half wave and folded dipoles, harmonic mobile and beam antennas. Resistance type SWR bridge —100 microampere meter—frequency range 0-150 MC—impedance range 0-600 ohms.



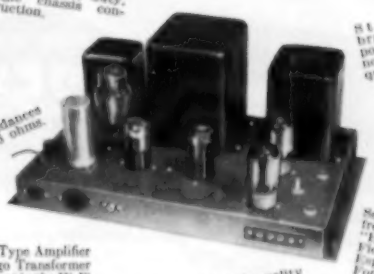
*Heathkit*
## ANTENNA COUPLER KIT

MODEL AC-1
**$14.50**
Shpg. Wt. 4 lbs.

For the Heathkit A'Y-1 Transmitter or any comparable Amateur Transmitter. Will handle power up to 75 watts at its 52 ohm coaxial input. Matches a wide range of antenna impedances with its L type tuning network and neon indicator. A tapped inductance provides coarse adjustment and a transmitting type variable condenser sets it "right on the nose." Will operate on the 10 through 80 meter bands.

**HEATH company**
A SUBSIDIARY OF DAYSTROM, INC.
BENTON HARBOR 15, MICHIGAN

# *New* LOW PRICED HEATHKIT SINGLE UNIT Williamson Type *High* Fidelity AMPLIFIER KIT




Here is the newest Heathkit Hi-Fi Amplifier at the lowest price ever quoted for a complete Williamson Type Amplifier circuit. The W-4 Model has been designed for single chassis construction, and only for the new Chicago Transformer Company Model BO-13 "super range" high fidelity output transformer. This transformer, a new development in the Hi-Fi field, is being offered at substantial saving over transformers of comparable quality. It is outstanding in performance and on the basis of our tests, we find it equal in every respect to transformers used in the W-2 and W-3 Heathkit series.

**LOW PRICES:**
Through utilization of a single chassis with resultant economy obtained through elimination of duplicate sheet metal fabrication, connecting cables, plugs, sockets, and a new Chicago "super range" output transformer, a 20% price reduction has been made possible without sacrificing kit quality.

**COMPONENTS:**
The new Heathkit W-4 uses the same heavy duty power transformer and choke. It has all of the features of previous models including individual jacks and a wire wound control to balance the output tubes—plastic high quality capacitors and the exact circuitry previously utilized in Williamson Type Amplifiers. Intermodulation distortion and harmonic distortion are both at the same low level as in the W-2 and W-3 models.

**CONSTRUCTION:**
Here is the opportunity for even the economy minded Hi-Fi enthusiast to enjoy all of the advantages offered through Hi-Fi reproduction of fine recorded music. Simplified step-by-step Construction Manual completely eliminates necessity of electronic knowledge or special equipment. Assemble this Amplifier in a few pleasant hours.

**COMBINATIONS AVAILABLE**

W-4M with Chicago "super-range" transformer only. Single chassis main amplifier and power supply. Shipping weight 28 lbs. Express only **$39.75**

COMBINATION W-4 with Chicago "super-range" transformer only includes single chassis main amplifier and power supply with WA-P2 preamplifier kit. Shpg. wt. 35 lbs. Express only **$59.50**

## NEW *Heathkit* 20 WATT High Fidelity AMPLIFIER KIT



MODEL A-9B

**$35.50**

Shpg. Wt. 24 lbs.

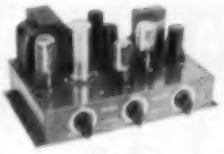
In keeping with the progressive policy of the Heath Company, further improvement has been made in the already famous Heathkit High Fidelity 20 Watt Amplifier. Additional reserve power has been obtained by using a heavier power transformer. A new output transformer designed and manufactured especially for the Heath Company, now provides output impedances of 4, 8, 16 and 500 ohms. The harmonic distortion level will not exceed 1% at the rated output.

**FEATURES:**
Outstanding features of the Heathkit 20 watt Amplifier include frequency response of ±1 db from 20 CPS to 20 KC. Separate (boost and cut) bass and treble tone controls. Four switch selected input jacks and a special hum balancing control. Flexibility is emphasized in the input circuits and proper equalization for all input devices is incorporated.

**TUBE LINEUP:**
12AX7 magnetic preamplifier and first audio amplifier. 12AU7 two stage amplifier with tone controls. 12AU7 voltage amplifier and phase splitter. Two 6L6 push-pull beam power output and 5U4G rectifier.

The Heathkit Model A-9B is excellent for custom installation and is designed for outstanding service at a very reasonable cost.

## *Heathkit* SIX WATT AMPLIFIER KIT



MODEL A-7B

**$15.50**

Shpg. Wt. 10 lbs.

An outstanding value, this economically priced 5 watt Amplifier is capable of performance expected only in much more expensive units. Only 2 or 3 watts output will ever be used in normal home applications and Model A-7B will be more than adequate for this purpose.

**SPECIFICATIONS:**
Two switch selected inputs are available for crystal and ceramic phono pickups, tuner, TV audio, tape recorder, and carbon type microphone. Model A-7B features separate bass and treble tone controls, push-pull balanced output stages, output impedances of 4, 8, and 15 ohms, and extremely wide frequency range ±1½ db from 20 CPS to 20 KC. Not just a souped up AC-DC job. Full wave rectification, transformer operated power supply and good filtering, result in exceptionally low hum level.

**MODEL A-7C**
Provides a preamplifier stage and proper compensation for the variable reluctance cartridge and low level microphone. $17.50

## *Heathkit* WILLIAMSON TYPE AMPLIFIER KIT



Here is the famous kit form Williamson Type *high fidelity* Amplifier that has deservedly earned highest praise from every strata of Hi-Fi music lovers. Virtually distortionless, clean musical reproduction, full range frequency response, and more than adequate power reserve.

**OUTPUT TRANSFORMERS:**
This outstanding Williamson Type Hi-Fidelity Amplifier is supplied with the famous Acrosound TO-300 output transformer. This quality transformer features the popular "ultra-linear" output circuit for clean maximum power level. Separate chassis for amplifier and power supply.

**SPECIFICATIONS:**
Frequency response within 1 db from 10 cycles to 100,000 cycles. Harmonic distortion at 5 watt output less than .5% between 20 cycles and 20,000 cycles. IM distortion at 5 watts equivalent output .5% using 60 and 3,000 cycles. Output impedances of 4, 8, or 16 ohms. Overall dimensions for each unit 7" high x 5½" wide x 11½" long.

**CONSTRUCTION MANUAL:**
This fine kit is supplied with a completely detailed step-by-step Construction Manual and the only effort required is the assembly and wiring of the pre-engineered kit. Even the complete novice can successfully construct this Amplifier and have fun building it.

**COMBINATIONS AVAILABLE:**

W-3 Amplifier Kit (Includes Main Amplifier with Acrosound Output Transformer, Power Supply and WA-P2 Preamplifier.) Shipping weight 37 lbs. Shipped express only..... **$69.50**

W-3M Amplifier Kit (Includes Main Amplifier with Acrosound Output Transformer and Power Supply.) Shipping weight 29 lbs. Express only **$49.75**

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Separate BFO oscillator tube and circuit.

Continuous coverage 550 KC—35 MC on 4 Bands.



MODEL AR-2

**$25.50**

(Less Cabinet)

Shpg. Wt. 12 lbs.

Phone—standby—CW panel switch.

RF gain control with AGC on-off switch.

Electrical band-spread tuning with logging scales.

An excellent example of typical Heath Company ability to produce top quality kit merchandise at ridiculously low prices, is the AR-2 Communications Receiver. Here is a transformer operated all-wave receiver with all of the desired features and none of the disadvantages commonly encountered in so-called "economy sets."

Receiver employs high gain miniature tubes and IF transformers, chassis mounted 5½" PM speaker, headphone jack, slide rule dial with Ham Bands plainly identified, and easy tuning with direct planetary drive. Continuous frequency coverage from 550 KC to 35 MC on 4 Bands, with electrical bandspread tuning and logging scales. Other features are RF gain control with AGC on-off switch—phone-standby-CW panel switch—prewound coils in a shielded turret assembly and copper plated chassis and shielding.

Uses 12BE6 mixer-oscillator, 12BA6 IF amplifier, 12AV6 detector-first audio, 12A6 beam power output, 12BA6 BFO oscillator, and 5Y3 rectifier. A lettered control plate is provided for the cabinet of your choice or you can order the optional Heathkit cabinet featuring the full size aluminum panel.

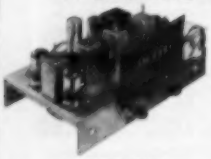
**RECEIVER CABINETS**

Proxylin impregnated fabric covered plywood cabinet available for BR-2 and AR-2 receivers. Includes aluminum panel, flocked reinforced speaker grill and protective rubber feet.

For BR-2 Receiver, Cabinet 91-9
Shipping weight 5 lbs. ..... $4.50

AR-2 Receiver, Cabinet 91-10
Shipping weight 5 lbs. ..... $4.50

## Heathkit FM TUNER KIT



MODEL FM-2

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Here is an FM Tuner that can be operated with your Hi-Fi Amplifier or through the "phono" section of the ordinary radio. Completely AC operated to eliminate problems usually encountered in "economy type" AC-DC tuner circuits. Features 8 tube circuit with separate mixer and oscillator, 3 double tuned IF stages followed by a limiter discriminator providing maximum sensitivity and selectivity across the full FM frequency band of 88 MC to 108 MC. The tuning unit is factory assembled and adjusted, thus eliminating tedious critical "front end" alignment problems. The attractive slide rule dial and vernier tuning combine to make the Heathkit FM-2 Tuner simple to operate.

## Heathkit BROADCAST BAND RECEIVER KIT



MODEL BR-2

**$17.50**

(Less Cabinet)

Shpg. Wt. 10 lbs.

The Model BR-2 Broadcast Band Receiver is designed especially for the beginner without any sacrifice of quality. This receiver features a transformer operated power supply, high gain miniature tubes, sharply tuned IF transformers, new rod type built-in antenna, and a trouble-free planetary tuning system. Exceptional performance with unusually high sensitivity, good selectivity, and excellent tone quality from the 5½" PM chassis mounted speaker. Can be used either as a receiver, tuner, or phono amplifier. Uses 12BE6 mixer-oscillator, 12BA6 IF amplifier, 12AV6 detector, 12A6 beam power output, and 5Y3 rectifier.

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## Certified Record Revue

(*Continued from page 58*)

worshippers of the brawny bass, but plenty of sparkling transients enrobed in wide frequency and dynamic range. The spacious acoustics of the old church add to the illusion of "presence." Surfaces in my copy were a little "ticky."

***STRAUSS, RICHARD***
**TILL EULENSPIEGEL'S MERRY PRANKS**
**DEATH AND TRANSFIGURATION**
**Pittsburgh Symphony Orchestra conducted by William Steinberg. Capitol P8291. RIAA curve. Price $4.98.**

Steinberg is a good man for this sort of repertoire. His readings are solid, authoritative, and he is never mannered as so many other conductors are with these works. However, neither are his readings overly inspired. Clemens Krauss still has the edge in performing "Till Eulenspiegel," and Furtwangler and Mengelberg outgun him with "Death and Transfiguration." In matter of sound the *Capitol* engineers have given Steinberg a big edge over all other competition. Strings, brass, all are clean and sharp, the important woodwinds in "Till" have a fine "liveness." Contrabassi are notably sonorous in "Death and Transfiguration." Wide range and good acoustics throughout. If you do not have these works in your library, this would be the choice for a modern version with the best sound and a fairly satisfying performance. Very quiet surfaces, curve was better with slight bass boost.

***BACH, J. S.***
**MAGNIFICAT IN D MAJOR**
**Pro Musica Orchestra, Stuttgart, conducted by Rolf Reinhardt with soloists and Chorus of Radio Stuttgart. Vox PL8890. Old NARTB curve. Price $5.95.**

The third version of this work on LP and one that certainly was needed. Both of the other versions were made back in the dark ages of LP and their sound leaves much to be desired. This version is not entirely without blemish . . . there is some choral "blast" and "fusion," strings are occasionally edgy, but generally this is good wide range sound. Dynamic expression is quite good and choral articulation is clean. I find this a most satisfactory performance, although the level of some of the soloists is pretty dismal. Reinhardt is a knowing conductor with this repertoire, and he essays a nice pace and achieves a judicious balance between chorus and instrumentalists. The singing is notable for its warmth and one feels sure the cast approached their task with proper reverence.

***LIEBERMANN***
**CONCERTO FOR JAZZ BAND AND SYMPHONY ORCHESTRA**
**The Chicago Symphony Orchestra and the Sauter-Finnegan Orchestra conducted by Fritz Reiner.**
***STRAUSS, RICHARD***
**DON JUAN**
**The Chicago Symphony Orchestra conducted by Fritz Reiner. Victor LM1888. RIAA curve. Price $3.98.**

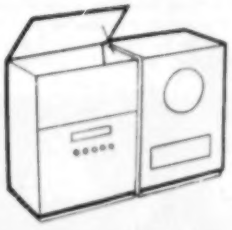
No, you're not seeing things! That is, indeed, the Sauter-Finnegan band sharing the same concert hall with the Chicago Symphony. The work is by the modern Swiss composer Liebermann and is in the 12-tone school. I'm afraid Mr. Liebermann's acquaintance with American jazz is not up-to-date, or somewhat limited, as most of the writing is extremely derivative and loaded with cliche. In spite of this, this manages to be an interesting work. The most notable feature is in


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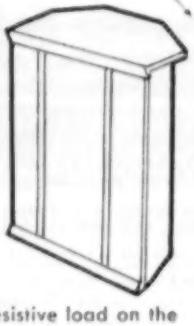
Model 80 equipment cabinet kit $27.00
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Rebel* 4



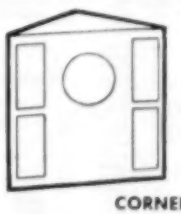
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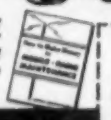
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his handling of orchestral textures which is widely varied and well done. I hardly need add that hi-fi fans will enjoy this as Mr. Sauter and Mr. Finnegan are much in evidence, and when their drummin' man gets wound up, it sounds more like Chicago's famous "Blue Note," than Orchestra Hall! The Chicago Symphony takes its unusual task in stride and Mr. Reiner must have had a real ball with the jazz boys. As you might expect, there is plenty of nice, clean, exciting bass, and percussion, with the strings getting in a lick now and then. For once, the wonderful acoustics of Orchestra Hall backfired. Too much reverb here for the type of orchestration. "Don Juan" on the flip side gets the best recording to date on LP. Some really sensational dynamics here and the entire work is afforded wonderfully clean sound. Brass is really weighty, almost pungent in strength. Performance-wise, I still like the old Clemens Krauss, but Reiner's is close and virtuosic in all aspects. Curve OK without adjustment. Odd crackling noise on the jazz side about halfway through first movement. Better check your copy.

***VERDI***
**TE DEUM**
***BOITO***
**MEFISTOFELE: PROLOGUE**

**NBC Symphony Orchestra conducted by Arturo Toscanini with The Robert Shaw Chorale and Nicola Moscona, bass. Victor LM1849. RIAA curve. Price $3.98.**

This is a fabulous recording and I can't recommend it too highly. The "Te Deum" is a worthy companion-piece to the "Requiem," but cast in more subdued colors. It has the advantage of reproduction which is considerably better than was that of the "Requiem." Not super wide range sound by any means, but still quite good. The purity of the voices in the Shaw Chorale are something to hear. Magnificently trained, their quality is almost ethereal. Toscanini's handling of the score is in keeping with the nature of the work. No furious drive and incandescent energy here . . . just the gently guiding hand and spirit dedicated to reveal the compelling beauty of the "Te Deum." Quite another matter is the incredible "Mefistofele! This is the white-hot Toscanini, the supercharged high compression man who drives his forces at a breakneck pace. I couldn't begin to tell you about this fantastic music. You'll have to listen to it yourself. I think you will agree that few works so completely encompass human emotions. The singing of the Columbus Boys Choir in the vocal scherzo, is unbelievably delicate, and contrasts with the towering might of the final climax and "Ave"! Again sound is quite good here, but if that climax could have been recorded with the Orthophonic technique, what a staggering sound we could have had. As it is, this is one of the thrilling moments in music and one of the things that makes music so ultimately rewarding! Don't miss this one!

**BAROQUE CHAMBER MUSIC**
**Haydn Society HSL-117. Price $5.95.**

This has a formidable title and admittedly won't appeal to many of the "hi-fi forever" boys, but there is some wonderful music and wonderful sound on this disc. Such musical giants as Telemann, J. C. Bach, and Handel are represented on this record in a group of quintets and trio sonatas. The orchestration is quite a clever combining of woodwinds with harpsichord and violin. Contrary to what most hi-fi fans might think, discs like this are invaluable for test purposes for the demonstration of instrument definition as well as being a good way to detect resonant points in speaker response. But quite aside from any hi-fi usage, the music is interesting and the performances of such stellar woodwind men as Jean-Pierre Rampal on the flute and

Pierre Pierlot on the oboe are a delight to the ear. Surfaces were moderately quiet in my copy.

*TCHAIKOVSKY*
**CONCERTO FOR VIOLIN AND ORCHESTRA IN D**
**David Oistrakh, violinist with Saxon State Orchestra, Dresden, conducted by Franz Konwitschny. Decca DL9755. Old NARTB curve. Price $3.98.**

This will be the first time, I believe, that a review of a David Oistrakh recording has appeared in this column. In spite of the stature of this artist, I honestly felt that the fantastically bad sound of the Russian masters negated any possible acceptance of the recording on artistic grounds alone. It is one thing to hear a great artist on an old record which is merely restricted in frequency response and dynamics. It is quite another thing to hear an artist, however great he might be, on a record which is a distorted, screechy, caricature of the man, his instrument, and the music. That is the way all previous efforts to record David Oistrakh have impressed me. This recording at hand is a different matter. Mr. Oistrakh has fortunately been permitted to travel outside the Soviet Union, and on the occasion of his visit to Germany, he recorded this work under the knowing auspices of *Deutsche Grammophon*.

While this recording is still a long way from competing with the best of contemporary hi-fi, it is an infinitely better sounding disc than the Russian horrors. Thus, newly revealed in a reasonable facsimile of modern sound, Oistrakh is truly a remarkable talent. His tone can only be described as lush . . . a full-bodied, richly vibrant thing of extraordinary beauty. His technique is impeccable and can only be equalled by a Szigeti or Francescatti. His musicianship is knowing and assured, even if at times, he can be a little mannered. His reading of the Tchaikovsky is fairly simple and straightforward, although there are certain ornamentations and embellishments, certain ideas about cadenza which are more Oistrakh than Tchaikovsky. Oistrakh is clever enough to realize that by depending on his phenomenal tone and prodigious technique, he has the battle half won. Couple this with his suave approach to the score and his uncanny ability to project "feeling" and sincerity, and you have a performance that is just about the best available.

The balance between violin and orchestra is such that it favors Oistrakh. Ordinarily this would be considered a blemish, but in this case it enables us to hear him better, as the orchestral accompaniment is so "muddied up" in many places that the sound of the violin would have been quite lost. What we hear of Oistrakh's violin is quite clean and smooth. No wiry screech here! The orchestral crescendi are the main source of sound trouble. As just noted, the sound is flabby, thick-textured with virtually no instrument definition. Bass is a "tubby" indistinguishable blur. Inexplicably, other sections aren't bad sounding at all, with fairly clean strings and much better definition. Considered as a whole, this has been the first opportunity to have even a remote idea of how Oistrakh really sounds. As a performance, this has few, if any peers. As far as sound is concerned, there are quite a number of other more illustrious versions. A cut in the bass helped the NARTB curve considerably.

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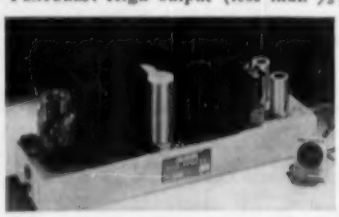
■ Features *extreme sensitivity* (1.5 mv for 20 db of quieting); works where others fail. Armstrong system, *adjustable* AFC on switch, *adjustable* AM selectivity, separate FM and AM front ends. Shielded and shock-mounted main *and* subchassis. Distortion below 0.04% for 1 volt output. Hum level: better than 90 db below 2 volts on radio, better than 62 db below 10 mv input on phono. 2 inputs. 2 cathode-follower outputs. Self-powered. Exceptional phono preamplifier with full equalization facilities. 15 tubes. Six controls: Bass, Treble, Volume, Channel/Phono Equalization, Tuning and Loudness Balance. Beautiful control panel. SIZE: 14¼" wide, 8½" high, 9¼" deep.



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best string sections in the country, as even the most perfunctory hearing of this disc will attest. Further, he knows how to handle his strings. Of the 11 recorded versions of the "Serenade for Strings" in the LP catalogue, this is the first recording with honest-to-gosh hi-fi sound. And what a difference it makes! The rich, cleanly-defined strings give this old warhorse new life and luster. *Capitol* has achieved a fine "big hall" type of sound here without sacrificing detail. The "Classical Symphony" is equally well served, although the reverb time here might be adjudged by some to be a mite excessive. The 14th version, this is among the most satisfying sonically and the performance is good enough to hold its own in such exalted company as the Koussevitsky, Toscanini, and Ansermet readings. You can't go wrong on this disc. No adjustment of the curve was required and as usual, the *Capitol* surfaces were flawless.

***BELLINI***
**NORMA (COMPLETE)**
**Maria Callas, soprano; Mario Filippeschi, tenor; Ebe Stignani, mezzo-soprano; Nicola Rossi-Lemeni, bass; Paolo Caroli, tenor; Rina Cavallari, soprano with Orchestra and Chorus of Teatro Alla Scalla, Milan, conducted by Tullio Serafin. Angel 35170. RIAA curve. Price $17.85. Three discs.**

This recording is a triumph of no mean proportions. "Norma" has always been a success when presented, but the scarcity of sopranos with vocal equipment adequate to cope with the enormous requirements of the role, has limited the opportunities to hear this work, both in this country and abroad. This situation has also prevailed with recordings of the score. There is but one other recording of "Norma" in the LP catalogue, and that is the *Cetra* version with Cigna. In this *Angel* recording we find "Norma" portrayed by the illustrious Maria Callas. No question can be raised here about vocal qualities. Miss Callas is ideally suited to the role and her performance bears this out. Her characterization of the tragic and tempestuous Druid Priestess is highlighted not only by her effortless and beautiful singing, but by her expert handling of the drama of her role. This is thrilling Opera and if I may say so . . . thrilling theater.

Miss Callas is ably supported by such expert practitioners of the operatic art as Filippeschi, as the Proconsul Pollione; by Ebe Stignani, as good here as she was in the *Cetra* effort; and by Rossi-Lemeni as Oroveso. Generally the soloists and the choral work are better here than in the *Cetra* version.

The conductor, Tullio Serafin, is an old hand with opera and under his expert direction, he elicits some beautiful playing from his excellent orchestra. His deft handling of chorus and orchestra, and indeed all other elements contribute in large part to the success of this recording. In matters of sound, there is no comparison between this and the *Cetra* recording. Wider in range and dynamics, smoother of string and much kinder to the voices, this is an infinitely better-sounding recording. It is unlikely that this splendid effort will soon be surpassed. If you like opera, you will find this particularly rewarding. The RIAA curve did not require adjustment and surfaces were quiet.

***RACHMANINOFF***
**THE ISLE OF THE DEAD**
***DUKAS***
**LA PERI**
**L'Orchestre de la Societe des Concerts du Conservatoire de Paris conducted by Ernest Ansermet. London LL-1155. RIAA curve. Price $3.98.**

This is a real prize! Each work is represented here in the third version to appear on

LP, and both are far superior to the preceding recordings. The "Isle of the Dead," Rachmaninoff's gloomy tone poem, is finally available with modern sound. The old Koussevitsky-*Victor* and the Mitropoulos-*Columbia* recordings of this work were transplanted to LP from earlier 78 rpm discs, and, of course, their sound betrays their origin. Ansermet's reading is more impressionistic than the Koussevitsky, which I think is all to the good, and his tempi and dynamics are more in keeping with the score. The sound is the most startling difference. The heavy dark strings of celli and contrabassi in the opening bars can at last be heard cleanly and well defined. The fortissimo passages are *really* loud and foreboding. Throughout the work, string tone is extraordinary for the contrasts of delicacy and sonority.

"La Peri" has had two previous recordings with sound which could be considered fairly hi-fi in quality. This recording is a hi-fi delight. There is a world of wonderful effects here, not the least of which are in the large percussion section. The silvery timbre of the celeste, the dry transients of the xylophone, the sharp rap of the snare and taut resonance of the tympani are heard with superbly clean definition. Happily, sound is not the only attraction since this is a perfectly charming score, and it contains lyric sections of exceptional, if not sensual, beauty. Once danced as a ballet, this would be a good vehicle for the always adventuresome New York City Ballet company. I think I would be safe in predicting it would be quite a hit! This kind of score is Ansermet's meat, and he makes the most of it. His hand is always light, his tempi just and his insight into the score, penetrating. Highly recommended for lovers of sound and good music alike.

*MENDELSSOHN*
**OVERTURES (FINGAL'S CAVE, FAIR MELUSINA, RUY BLAS, CALM SEA AND PROSPEROUS VOYAGE)**
**Vienna Philharmonic Orchestra conducted by Carl Schuricht. London LL-1048. RIAA curve. Price $3.98.**

Warhorses? Assuredly, but you've never heard them done like this! Positively the biggest sounding disc of overtures in the catalogue. This recording has everything . . . lively inspired readings by Schuricht, who has a habit of springing surprises like this, the superb playing of the Vienna Philharmonic, and terrific sound. Clean strings, powerful insistent bass drum and tympani, rousing bright brass, sweet woodwinds . . . all combine with wide frequency response and awesome dynamics. The acoustic perspective is definitely "big hall," a huge robust sound, yet detail is not lacking. A little coarseness near the inner diameter is the only flaw in an otherwise super-sounding recording. A "goody" for the beginning audiophile and "old hand" as well! The RIAA curve was better with slight bass boost. Moderately quiet surfaces in my copy.

*VERDI*
**OTELLO (COMPLETE)**
**Mario del Monaco, Renata Tebaldi, Aldo Protti, Fernando Corena, soloists with Orchestra and Chorus of L'Accademia Di Santa Cecilia Rome conducted by Alberto Erede. London LLA-24. RIAA curve. Price $17.85. Three discs.**

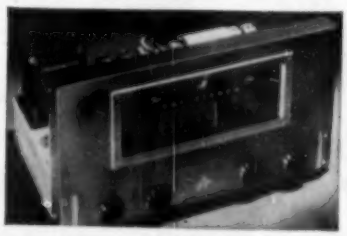
A few weeks before this was written, over 3000 people jammed their way into the Metropolitan Opera House in New York to hear Mario Del Monaco and Renata Tebaldi in "Otello." It was a triumphant evening for all concerned, especially the debuting Miss Tebaldi. The press gave almost unanimous rave notices the next day, and the New York press is a tough bunch to sell. Now through the


"Dream Set!"
—LIFE Magazine

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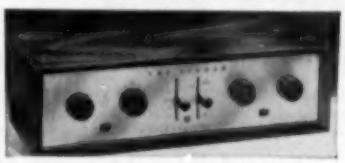
SERIES FIFTY

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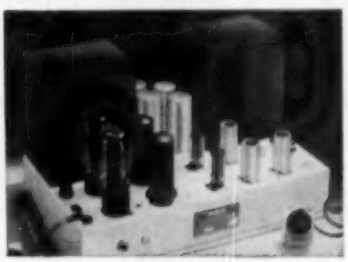
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courtesy of *London*, you can recreate this great night of opera in your own home. Sure, there are some changes here and there, but del Monaco and Miss Tebaldi are still on hand which is the important thing. Any recording of "Otello" must invariably be compared with the great Toscanini's effort. I must confess that good as Mr. Erede is on this album, he can't touch the Maestro, at least not from the orchestral standpoint. And therein lies the whole difference between these two recordings. For "Otello" is, after all, an opera and can't stand or fall on the strength of orchestral virtuosity alone. In every other aspect this *London* recording is superior to the Toscanini. The soloists, especially the principals, are much surer of their ground, the chorus more properly "Italianate" and the general atmosphere more in keeping with the nature of the work. It is beyond the power of words to convey the tremendous thrill and drama of del Monaco's & Miss Tebaldi's portrayals.

*London* has not forgotten the sonic values in this recording, and in spite of the excellence of their recent issues, like "Der Rosenkavalier," etc., it is safe to say this is *London's* finest opera recording. The orchestra is well defined with nice edgeless strings, brilliant brass, and solid and accurate percussion. The voices are captured with every intonation, every nuance, resonantly alive. Choral and orchestral blur is virtually non-existent and the balance between them is sensible. All is very wide range and distortion-free and the dynamics quite impressive. Curve and surfaces OK.

### Tape Review

***VIVALDI***
**CONCERTO GROSSO IN D MINOR**
***MOZART***
**EINE KLEINE NACHTMUSIK**
***BACH-STOESSEL***
**PRELUDE IN E MAJOR**
***TCHAIKOVSKY***
**SERENADE FOR STRINGS**
***BOLZONI***
**MINUET**

**Sorkin Symphonette conducted by Leonard Sorkin. Webcor 2923-3 7" reel, double-track, 7½ ips. $12.95.**

*Webcor* has engaged Leonard Sorkin of Fine Arts Quartet fame, to direct its prerecorded tape division, and this is one of the first fruits of that undertaking. The repertoire here is certainly catholic and should not be lacking in appeal. The Vivaldi is particularly well performed and the "Serenade" makes an interesting comparison with the Steinberg-Pittsburgh Symphony disc of the same work, reviewed a few pages back. Of course, we must keep in mind that the string complement in the Pittsburgh Symphony is much larger than anything employed here, and therefore will have more "weight" and sonority. However, Sorkin has chosen his ensemble with care and the results, while less spectacular, are quite gratifying. If the string tone in the disc was good, and it was . . . this is so much better, it is amazing, even to one who is used to superior string work on tape. The edgelessness of the strings is a delight to the ear, yet they have more bite, more authority when needed. The overtones are much cleaner and more in evidence. So, in spite of the smaller number of performers here, they don't sound as thin as you might expect. The performance is workmanlike and competent and no one could have much reason to take issue with it. The other works sound equally smooth and well integrated. All are heard in gratifyingly wide range, both frequency-wise and in dynamics. Tape hiss was at such a low level as to be unnoticeable, or at least very unobtrusive. As played back on my *Ampex* 600, equalization was no problem. A very good tape, with quality which is the equal of anything available presently. —30—

## Low-Pass Filter

(*Continued from page 47*)

the low-pass is distinctly more effective than the simple gradual high frequency droop of a tone control. The cut-off cannot be too sharp, however, or the filter will "ring," giving a metallic quality to the music. The filter described here does not cut off suddenly enough to introduce this metallic quality.

There are two main characteristics to a filter: the attenuation rate and the sharpness of the "shoulder" at the cut-off frequency. Attenuation rate depends on the number of reactive elements (*i.e.*, coils plus capacitors) in simple filters. For each coil or capacitor we get 6 db per octave. In the filter described there are no coils and three capacitors, and we get 18 db per octave. Every time the frequency doubles the response goes down by eight times. We would get the same rate in a filter consisting of one coil and two capacitors. This 18 db per octave rate can be scaled off the curves of Fig. 2A (left), in the "cut-off" region where the curves are straight sloping lines.

The extent of the curved portion or shoulder depends on the "*Q*" of the coils and capacitors. In an *LC* filter which has coils of infinite "*Q*," the curve would look like two straight lines (provided the terminations were correct). *RC* filters have an "equivalent *Q*", which is very low indeed, less than 1, and give the very droopy curves like curve 1 in Fig. 2B (right). The effect of the feedback circuit and tube is to boost the equivalent "*Q*" considerably.

The trouble with *LC* filters is that they require definite and critical source and load impedances connected at input and output. While the proper impedance can be presented to the filter by using resistors, the problem of making the filter variable is still messy. If the terminations are wrong, the response curve acquires either a droopy shoulder or a nasty peak. If we try to vary the cut-off frequency by varying the inductance, it turns out that the terminating resistances have to be varied too. If we want the terminations to stay constant, then we have to vary both *L* and *C* simultaneously. In addition, air variable capacitors cannot be used in the audio range because the required inductances to go with them become impossibly large.

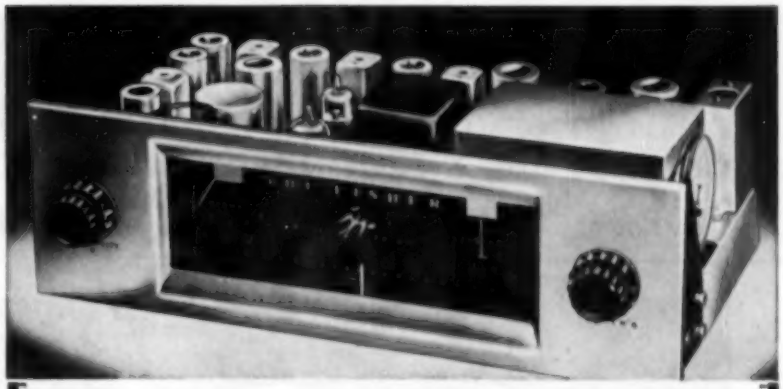
This information is given as background data for the curious. Problems of instrument design almost always involve balancing a host of factors against each other, a constant search for artifices, dodges, and subterfuges.

Although the author originally designed this filter for use with his audio amplifier, it works beautifully on ham equipment too.

### REFERENCE

*1. Fleming, Lawrence: "Acoustic Measurements for the Audiophile,"* Radio & Television News, *September 1954.*

—30—



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This feature of the Model TV-50 Genometer will permit you to throw an actual Bar Pattern on any TV Receiver Screen. Pattern will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars. A Bar Generator is acknowledged to provide the quickest and most efficient way of adjusting TV linearity controls. The Model TV-50 employs a recently improved Bar Generator circuit which assures stable never-shifting vertical and horizontal bars.

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The Model TV-50 includes *all* the most frequently needed marker points. Because of the ever-changing and ever-increasing number of such points required, we decided against using crystal holders. We instead adjust each marker point against precise laboratory standards. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc. (3579 Kc. is the color burst frequency.)

The Model TV-50 comes absolutely complete with shielded leads and operating instructions. Only ..... **$47.50 NET**

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*Superior's new Model 670-A*

# SUPER METER

## *A COMBINATION* VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS

**SPECIFICATIONS:**

**D.C. VOLTS:** 0 to 7.5/15/75/150/750/1,500/7,500 Volts
**A.C. VOLTS:** 0 to 15/30/150/300/1,500/3,000 Volts
**OUTPUT VOLTS:** 0 to 15/30/150/300/1,500/3,000 Volts
**D.C. CURRENT:** 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
**RESISTANCE:** 0 to 1,000/100,000 Ohms 0 to 10 Megohms
**CAPACITY:** .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers)
**REACTANCE:** 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
**INDUCTANCE:** .15 to 7 Henries 7 to 7,000 Henries
**DECIBELS:** —6 to +18 +14 to +38 +34 to +58

**ADDED FEATURE:**

**Built-in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.**

The Model 670-A comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions.

**$28.40 NET**



*Superior's new Model TV-11*

# TUBE TESTER

**SPECIFICATIONS:**

★ Tests all tubes including 4, 5, 6, 7, Octal, Lock-in, Peanut, Bantam, Hearing Aid, Thyratron, Miniatures, Sub-Miniatures, Novals, Sub-miners, Proximity fuse types, etc.

★ Uses the new self-cleaning Lever Action Switches for individual element testing. Because *all elements are numbered according to pin-number in the RMA base numbering system*, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.

★ The Model TV-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus *it is impossible to damage a tube by inserting it in the wrong socket.*

★ Free-moving built-in roll chart provides complete data for all tubes.

★ Newly designed Line Voltage Control compensates for variation of any Line Voltage between 105 Volts and 130 Volts.

★ NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

The model TV-11 operates on 105-130 Volt 60 Cycles A.C. Comes housed in a beautiful hand-rubbed oak cabinet complete with portable cover.

**$47.50 NET**

***EXTRA SERVICE***—The Model TV-11 may be used as an extremely sensitive Condenser Leakage Checker. A relaxation type oscillator incorporated in this model will detect leakages even when the frequency is one per minute.

**SUPERIOR'S NEW MODEL TV-40**



# C.R.T. TUBE TESTER

★ **A complete picture tube tester for little more than the price of a "make-shift" adapter!!**

The Model TV-40 is absolutely complete! Self-contained, including built-in power supply, it tests picture tubes in the only practical way to efficiently test such tubes: that is by the use of a separate instrument which is designed exclusively to test the ever increasing number of picture tubes!

**EASY TO USE:**

Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base *(ion trap need not be on tube)*. Throw switch up for quality test . . . read direct on Good-Bad scale. Throw switch down for all leakage tests.

★ **Tests *all* magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton!!**

**SPECIFICATIONS:**

- Tests *all* magnetically deflected picture tubes from 7 inch to 30 inch types.
- Tests for quality by the well established emission method. All readings on "Good-Bad" scale.
- Tests for inter-element shorts and leakages up to 5 megohms.
- Tests for open elements.

Model TV-40 C.R.T. Tube Tester comes absolutely complete—nothing else to buy. Housed in round cornered, molded bakelite case. Only

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☐ Model 670-A.....Total Price $28.40 $7.40 within 10 days. Balance $3.50 monthly for 5 months.

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**Rigid control** of internal conductive coating provides utmost service reliability.

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**One-piece construction** of parts assures better alignment.

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# TUNG-SOL

## RADIO AND TV TUBES

**You Can Build a Reputation On Tung-Sol Quality**


## Shrinking Pictures

*(Continued from page 57)*

line voltage at times reaches above-average levels in the set-owner's location, however, a substitution of this kind is not recommended, since excessive "B" voltages will be produced, and components may be damaged.

Height losses promoted by line voltage reductions may often be eliminated by substitutions of more efficient vertical amplifier tubes. Thus, a 6K6 may be replaced by a 6W6, 6V6, or 6Y6G; or a 12BH7 may be used in place of a 12AU7. It is important to note that the heater circuit present must be able to handle the larger heater drain if required.

Early-model yokes which perform satisfactorily in the presence of normal line voltages will often produce insufficient width when the line voltage becomes low, even with the width control at maximum. Replacement of the yoke with a later and more efficient equivalent will remedy this trouble, if tube substitutions are inadequate to do the job.

A final service note: Raster shrinking may be caused by *two* tubes whose emission drops after an interval of normal receiver operation. It is important, then, to note whether *any* improvement manifests itself when a tube has been substituted. If an incomplete restoration of size does occur when some tube is substituted, leave that tube in and go on to hunt for an additional source of trouble. —30—

## HAM PICNIC

**THE Clifty Falls Picnic, sponsored by the Madison Amateur Radio Club, Madison, Ind., will be held at Poplar Grove, Clifty Falls State Park in Madison on Sunday May 15th from 10 a.m. to 4 p.m.**

**The committee has announced that there will be no registration fees— just the 10 cent admission charge to the park.**

**The event has been planned as a family affair with each family being asked to bring its own picnic lunch. The location is only a short distance from Cincinnati, Louisville, or Indianapolis so the group is hoping for a big turnout, rain or shine.**

**Contact W9QOT, RFD #6, Madison, Ind. for further details.** —30—

## WESTERN N. Y. HAMFEST

**THE Rochester Amateur Radio Assn. is sponsoring its annual "Western New York Hamfest" on Saturday, May 21st in the Doud American Legion Post at 898 Buffalo Road near the western city limits of Rochester.**

**A program of interest to mobile, DX, traffic, v.h.f-u.h.f., CD, and hi-fi enthusiasts has been planned. Registration is from 1 to 5 p.m. with the banquet at 7 p.m.**

**For advance registration, write to Rochester Amateur Radio Association, P. O. Box 1388, Rochester 3, New York. The tariff has been set at $3.75 per person.** —30—


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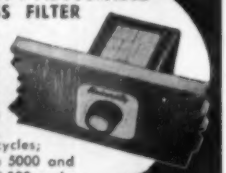
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## Diode Oscillator

(*Continued from page 55*)

diode have hitherto been primarily of academic interest for the simple reason that, although it is easy enough to demonstrate the phenomenon, the diode usually burns out within a matter of seconds or minutes. The author was able to overcome this drawback by means of several expedients. First, mounting brackets were made which, by virtue of their thermal conductivity, mass, and radiating area, permit the diode to operate at a temperature only slightly higher than ambient. Secondly, protection is conferred by a power supply deliberately designed to have poor voltage regulation. Finally, a small capacitor connected directly across the diode protects it from injurious transients. This oscillator has survived a thirty-six hour operational test and a great deal of use by a neighborhood lad endeavoring to master the code in order to secure his "ham" ticket. It is believed that there is no reason why the life span of the diode so employed should not at least equal that expected from more conventional applications.

The diode supporting brackets should be constructed very carefully. It is very important that the holes for the diode cartridge be no larger than necessary to provide a tight fit. A sloppy mounting hole will defeat the purpose of the scheme inasmuch as the resulting poor thermal contact will not allow efficient transference of heat from the crystal to the bracket.

The schematic diagram is shown in Fig. 2. It is suggested that the constructor should use the same audio transformer as specified in the parts list. This one was found to be best for this purpose. Other transformers tried by the author did not have a high enough "*Q*" under the operating conditions. Experiments indicate that the lower audio frequencies are favored by the diode, notwithstanding the "*Q*" of the resonant circuit. The tone selector switch, $S_1$, enables a choice of frequencies of approximately 500, 750, and 1250 cycles per second. The variable resistance, $R_1$, may be likened to a regeneration control. The analogy is striking inasmuch as a frying noise can be heard when this control is advanced to the threshold of oscillation.

The function of the series combination, $R_2$ and $C_5$, is to prevent excessive loading of the oscillatory circuit by the phones. Without the isolation provided by these two components, the key-up and key-down frequencies would be different and the keying would be "chirpy." This, of course, is exactly what happens in a heavily loaded vacuum-tube oscillator.

Operation should be brought about by setting $R_1$ for maximum resistance and $S_1$ for oscillation at the lowest frequency, that is, with $C_5$ in the circuit. After the line voltage is connected, $R_1$ should be slowly advanced. Oscillation should commence when $R_1$ has been


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turned through about 80% of its allowable rotation. Some diodes have to be provoked into oscillation by several fast repetitions of this procedure. However, once oscillation occurs, such diodes settle down to stable operation. If trouble is encountered, it likely will be with a tendency toward generation of periodic oscillations interspersed by dead intervals, somewhat suggestive of a vacuum-tube oscillator in which the grid leak resistance is high enough to enable periodic blocking to take place. The remedy, in some instances, is to allow the diode to age for a half hour or so, after which time several rapid sweeps of $R_1$ usually brings about continuous operation. After this treatment, such diodes give satisfactory results. This trouble need not be contended with if one has a selection of several diodes from which to choose. The author obtained results "right off the bat" with four out of six new diodes. The fifth of these was finally pampered into good operation whereas the sixth could not be coerced to oscillate at all. Again, from a selection of sixteen used diodes, ten turned out to be excellent oscillators. The eleventh oscillated only at 500 cps, and the remaining four were not satisfactory. All diodes showed a high front-to-back resistance ratio but this is not the complete story of a diode's ability to oscillate. The real figure of merit is the existence of the negative resistance region and this can be present even when the forward-to-backward resistance ratio is relatively low.

Under normal operating conditions, the oscillating germanium diode is as rugged as a tube. However, do not experiment while the circuit is energized, for shorts and wrong connections can produce transients of sufficient amplitude to injure the diode. Transients generated by manipulation of $R_1$ or $S_1$ are completely absorbed by $C_1$. It will be found that keying is clean cut and the tone, being quite rich in both even and odd harmonics, is very pleasing to the ear. There is sufficient power available so that two or several pair of earphones can be used if so desired.

The oscillating diode is a circuit element occupying a position between the tube and the transistor. The code oscillator herewith described represents a practical application of a neglected phenomenon. There certainly will be others that will suggest themselves to the experimenter. -30-

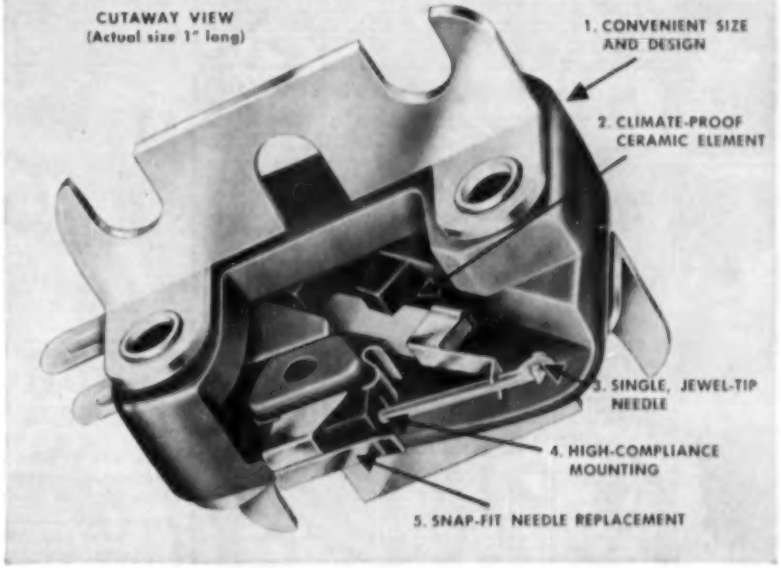
## NEW MEXICO HAMFEST

**THE Amateur Radio Caravan Club of New Mexico's Albuquerque Chapter will sponsor the 5th Annual N. M. State Hamfest on June 4th and 5th. Stations will be on 29.6 mc. and 3838 kc. for contests and to direct mobiles.**

**All amateurs whether New Mexico residents or not are invited to attend. For further information contact the club at 107 Washington Street, S.E., Albuquerque, N. M. A varied program awaits attendees.** -30-


# Gives your customers brilliant results ...pays off for you!

**NEW SONOTONE 1P CERAMIC CARTRIDGE**

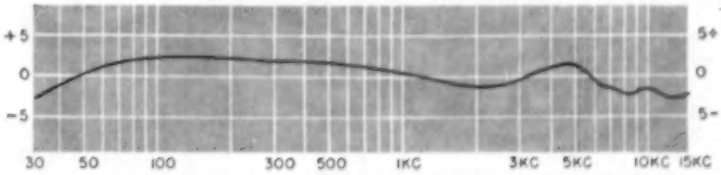



1. Easy to install. Just two models fit most arms now in use. Cartridge is less than 1" long, 8/10" wide with bracket. Time-saving hardware included.
2. Ceramic element gives flat response (see curve) —requires no preamplification or equalization. No deterioration problems as with other types... virtually immune to hum pickup.
3. Replaceable needle, diamond or sapphire. Models for 33-45 rpm, or 78 rpm.
4. Extreme lateral compliance and low-mass design give superior tracking, low wear.
5. Needles snap in, snap out easily.

**Tap the Huge 33-45 RPM Replacement Market!**

Install this new Sonotone 1P, and give your customers exciting, true, wide-range response. At one stroke, you make a good sale, cut installation time, avoid problems found with other types of cartridges... and build your reputation for quality work and professional advice. No other cartridge has all the advantages this 1P gives you! With sapphire, $8.50; with diamond, $30.

**RESPONSE 30-15,000 ± 3 DB!**




Response to new industrywide RIAA characteristic shows how 1P ceramic cartridge *self-equalizes*, because it works on "amplitude" rather than "velocity" principle. Here's startlingly improved performance for your customers' phonos!

**SONOTONE** CORPORATION ELMSFORD, N.Y.

*Write Dept. CN-55 for free Phono Modernization Manual*

# McGEE'S OUTSTANDING VALUES FOR MAY



## MINIATURE BROADCASTING STATION FOR THE HOME

**NEW 1955 MODEL WITH CRYSTAL MIKE $9.95**



Sensational new model MCL-83 miniature broadcasting station for microphone and phonograph. Can be received on any broadcast radio in the home. No wires to connect, tunes in just like a radio station. Has input jacks for crystal mike or record player. Complete with 12AX8 and 70L7 tubes and instructions. Operates on 110 volts AC. Simple to operate; one control fades from microphone to record. Frequency can be adjusted so as not to interfere with local radio stations. Miniature broadcasting station, complete with crystal hand mike and instructions. Ship. wt. 4 lbs. Net price $9.95.



## 6" SESSIONS CLOCK-TIMER

**With Plastic Cabinet $3.95**

6" Sessions Clock-Timer in plastic case 7" x 9⅝" tall, 3" deep. Was intended for a kitchen clock radio. Lower part of case was used for a small radio chassis. Lower portion has a usable space of 6½" x 4" high and 2½" deep with 3" diameter hole in front. Many ways this attractive clock and cabinet could be used, such as mounting a small bell below the clock for use as a kitchen clock and timer. Clock has sweep second hand and 15 amp. 125 volt switch to turn on appliances at any pre-set time. Case available in ivory, Green or Yellow. Stock No. MCT-63. Sessions Clock-Timer with case of your color choice. Sale price only $3.95.



## RC-600 REGENCY UHF CONVERTER $16.95

UHF converter SCOOP! Brand new RC-600, Regency UHF converters. Special sale price only $16.95. Regular dealers net was $37.46. All channel UHF, 14 thru 83. Only 100 to sell. Model RC-600. Ship. wt. 6 lbs. Special sale price only $16.95.



## RMS VHF TV BOOSTER $4.95

Latest RMS TV booster for all VHF channels. Continuously variable for channels 2 thru 13. Variable gain control prevents overloading on powerful stations. Brown plastic case 4½" x 6½" x 5". Operates on 110 volt, 60 cycle AC. Ship. wt. 4 lbs. Model SP-6, RMS TV booster, special sale price only $4.95.



## 6-TUBE, 2-BAND RADIO KIT $14.95

**6-18 MC 550-1650 KC**

6 tube, 2 band AC-DC radio kit, complete with speaker and plastic cabinet. Popular with schools and colleges for training in radio. Receives broadcast and 6-18 mc shortwave. Full 3 gang superhet with 5" speaker and slide rule dial. A complete kit with tubes: 12K8, 2-12SK7, 12SQ7, 50L6 and 35Z5. diagram and instructions. Cabinet 13" x 6¼" x 6¼". Ship. wt. 12 lbs. Model MES-2, Net $14.95.



## 3-SPEED AMPLIFIED PLAYER KIT $10.95

## 3-TUBE AMPLIFIER—8" SPEAKER

Now, 3 speed amplified record player kit for only $10.95. Leatherette covered cabinet 9½" x 12" x 14½" high, made to set on floor. Completely wired 3 tube amplifier has separate tone and volume controls, 12SF5, 35W4 and 50B5 tubes. Heavy 8" speaker, all play pickup, motor and turntable. Cabinet is precut. All you have to do is fasten the amplifier, speaker and motor in the cabinet. Only a few minutes required to assemble. Complete with simple, easy to follow instructions and all necessary items to build this 3 speed amplified record player. Buy this kit at less than the cost of a speaker. Shipping weight 15 lbs. Model No. ARP-347M, Sale price only $10.95.



## 50-WATT BOOSTER AMPLIFIER

**50-WATT BOOSTER AMP. $39.95**

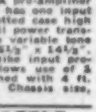
**2-Mike Pre-Amp $12.95 Extra. Not a Kit, but a Manufactured Amp.**

A sensational value. A 50 watt booster amplifier with push-pull, parallel 6L6 output tubes. Connect to your present amplifier as a booster or use with the PR-3X pre-amplifier to allow the use of 2 microphones and one low level input. The amplifier has one input jack with 1 volt input giving 50 watts of audio. Amplifier has a 6 lb. potted case high fidelity output transformer with taps at 4-8-16-60 and 250 ohms. 225 mil power transformer and 5U4G rectifier. Includes tubes: 4—6L6, 7N7 and 5U4G. Two variable tone controls for master volume and bass boost tone control. Chassis size, 8" x 8½" x 14½". Model No. PA-250X. Ship. wt. 26 lbs. Sale price, $39.95. PR-2X, 2 mike 10 watt preamplifier plugs in directly to the PA250X 50 watt booster amplifier. Allows use of 2 microphones, either crystal or dynamic and one low level input. Furnished with 4 ft. connecting cable and plug for remote control of the 50 watt booster. Chassis size, 6½" x 3½" x 2½". Model PR-2X, Sale price, $12.95.

## 10" PM SPEAKER AND LEATHERETTE BAFFLE

Now, buy a full 10" PM speaker with Alnico V magnet with our top quality 10" leatherette wall baffle, both for only $6.49. Baffle is finest lock joint construction with rounded corners, quality covering and plastic grill cloth. Stock No. 10BH. 10" speaker and baffle, $6.49 each, 2 for $10.00.

**BOTH FOR $5.49**



12" PM speaker with same quality 12" wall baffle, only $7.49 each, 2 for $14.00.

**2 for $10.00**

## FAMOUS STANDARD COIL CASCODE TUNERS

TV-2000 series Standard Coil cascode tuners complete with 6J6 and 6BK7 or 6BQ7 tubes. Thousands of TV sets use this famous tuner. Tunes 12 channels (2 thru 13). For 21 mc I.F. circuit. This tuner will give 2 to 1 better reception than the old pentode type. Many servicemen replace all older tuners with this cascode mode. Available with either 3½" or 4½" shaft lengths. A tremendous purchase makes our low $12.95 price possible. Specify shaft length desired. Stock No. TV-2000-3. Sale price $12.95 each, 2 for $25.00.

**SALE PRICE $12.95**

**2 FOR $25.00**



No. 2103-5, 41 mc Standard Coil cascode 12 channel tuner with 41 mc I.F. for intercarrier sound circuits. With 6BK7 and 6J6 tubes. $12.95 ea., 2 for $25.00.

3½", 4½" or 6" shaft. Sale price,

No. TV-4001-7, 41 mc Standard Coil cascode 12 channel tuner with .3th position for use with separate UHF tuner. 6½" shaft. With tubes 6BQ7 and 6J6. Used in Sentinel, WW, Arvin, etc. Sale price, $12.95.

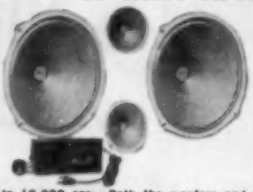
## STANDARD COIL PENTODE TV TUNERS $9.95

SC-947 Standard Coil Pentode 12 channel tuner, as used by Emerson 660D, 695, etc. Fine tuning shaft insulated from ground. Filaments shunted with resistor for 0.6 amp drive. 2½" shaft. With tubes 6BC8 and 6J6. Sale price, $9.95.

SC-948 Standard Coil Pentode 12 channel tuner with 6BC8 or 6AG8 and 6J6 tubes. Millions of TV sets now in use have this tuner. 2½", 3", 4" or 5" shaft length. You can replace that old tuner cheaper than it can be repaired. Sale price, $9.95.

Matching knobs for Standard Coil tuners. Set No. SCK-2 for fine tuning and channel selector. Set VCK-2, matching volume and contrast knobs. Either set only 89c a pair.

## 25 WATT HI-FI SPEAKER SYSTEM



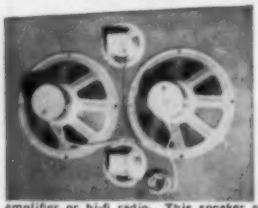
**2-12" Woofers 2-5" Tweeters Power Supply and L-C Cross-over Network**

**SALE PRICE $24.95**

25 watt, High-Fidelity Dynamic Speaker System, complete with 3000 cycle genuine inductance-capacitance cross-over network, two 12" woofer speakers, two 5" high frequency tweeter speakers and separate 110 volt AC power supply, less console baffle for only $24.95. Frequency response 20 to 18,000 cps. Both the woofers and the tweeters are fine quality dynamic speakers with fields excited to saturation by the power supply. Tweeters are specially made with cones designed to respond only to the high frequencies of the audio spectrum. The 3000 cycle cross-over network is of the high quality inductance-capacitance type which prevents frequencies below 3000 cps from entering the tweeters and eliminates frequencies above 3000 cps from the woofer circuit. The cross-over network system is simple to connect to any 4 or 8 ohm output of your high fidelity audio amplifier or radio. No. SP-12125CR, High Fidelity Dynamic Speaker System, Ship. wt. 15 lbs. Sale price, $24.95.

No. SPS-1213S, High Fidelity Dynamic Speaker System, as described above, but less the 3000 cycle cross-over network and with a separate attenuator control. Sale price, $14.95.

## NEW 4 SPEAKER 25 WATT HI-FI SYSTEM



**2-12" Woofers 2-5" Tweeters and Baffle**

**With 350 Cycle L-C Type Crossover Network....$34.95**

**SALE PRICE $24.95**

New 4 speaker, high fidelity speaker system with baffle board. ¾" laminated plywood baffle is 21½" x 28½" long. Complete with two 12" high fidelity woofers having 32 oz. Alnico 3 magnet and two 5" tweeter speakers for high frequencies. Frequency response 50 to 18,000 cps. Easy to connect to any 8 ohm output of your amplifier or hi-fi radio. This speaker system is ideal for a home music system. Can be installed in wall or cabinet of your choice. Note: baffle will not fit cabinet shown below. Stock No. 4P-55, 4 speaker system. Ship. wt. 20 lbs. Sale price $24.95. 4P-55 speaker system with Model CR-350, $30.00 list. 350 cycle inductance-capacitance type cross-over network, $14.95. New interwoven plastic grill cloth for above; either golden blend or mahogany, $2.00 extra.

## 4 SPEAKER-HIGH FIDELITY SPEAKER SYSTEM

**With $25.00 List L-C Crossover Network. Choice of Blend Oak, Mahogany or Walnut.....**

**$49.95**



**NEW 600 CYCLE CROSSOVER NETWORK**

**$25.00 LIST SALE PRICE ..... $9.95**

**CABINET AND BAFFLE WITH GRILL ONLY ..... $24.95**

New High Fidelity console speaker system, housed in an attractive cabinet 37½" high, 24" wide and 20½" deep. Your choice of three beautiful finishes: blonde oak, mahogany or walnut. Cabinet is equipped with 4 PM speakers, 12" woofer, 10" middle range and two 5" speakers which respond only to the high frequencies. Speakers are fed from a 600 cycle inductance-capacitance type cross-over network. Easy to connect to any amplifier that you now have. Input matches any 8 ohm output tap. Response 20 to 20,000 cycles. Has separate gain control for middle range and high frequency speakers. Any amplifier will sound better with this speaker system. Model HF-121085, Ship. wt., 90 lbs. Specify cabinet finish desired. Sale price, $49.95.

High fidelity console speaker cabinet with baffle and grill, less speakers and cross-over network for only $24.95. Your choice of blonde oak, mahogany or walnut finish with baffle cut for 12", 10" and 2-5" speakers. Complete with new interwoven plastic grill cloth. Same cabinet as used in the above speaker system. Specify if you want baffle board ground. Stock No. MCC-4, Ship. wt., 80 lbs. Sale price, $24.95.

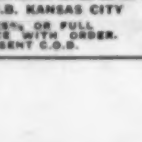
New $25.00 list, 600 cycle inductance-capacitance type cross-over network as used in the HF-121085 speaker system. Designed to fed frequencies below 600 cycles to the woofer only and frequencies up to 20,000 cycles to the middle range and tweeter speakers. Housed in metal case with terminals for input from any 8 ohm amplifier output and connections to low and high frequency speakers. Has gain control. Frequency response 20 to 20,000 cps. Model CR-600, ship. wt., 6 lbs. Sale price, $9.95.

## NEW IMPERIAL IV with General Electric 8 in. HIGH FIDELITY SPEAKER

**$19.95**



New 1955 Model IMPERIAL IV, High fidelity speaker system with General Electric 8" speaker. Housed in a high quality leatherette covered plywood cabinet 10" x 10" x 20" long. Fully enclosed; covered on all sides except back. Use as an auxiliary speaker or with any high fidelity radio, amplifier or home music system. The IMPERIAL IV contains a General Electric Model 8S0 extended range high fidelity 8" PM speaker with 8.8 oz. Alnico V magnet and curvilinear cone with 8 ohm voice coil and a 5" tweeter. Response 50 to 15,000 cps. Model IV Imperial $19.95.



**TWO-TUBE SARKES-TARZIAN TV TUNER $8.95 WITH TUBES**

New 2 tube Sarkes-Tarzian No. TT-3A, 12 channel TV tuner, 21-25 mc. Popular in many makes. Also, ideal for general replacement use. Has 6J6 and 6BC8 tubes. Used in CBS, Arvin, Crosley P17TOLBU, TOLH, TOLU, P21COLBH, etc. Also, ideal for general replacement use. A good replacement for one tube tuners. 3½" shaft. No. TT-3A. Sale price, $8.95. Takes SCK-2 knob set described at left.

## 3 TUBE SARKES-TARZIAN, RCA, GEN'L. INST.

V-53736, 3 tube Sarkes-Tarzian, 12 channel tuner, with 2-6AG5 and 6C4 tubes. 3" shaft. Used in Air King 700 series. Sale price, $7.95.

Type 3, 3 tube Sarkes-Tarzian 12 channel tuner with 6C4, 6BH6 and 6AG5 tubes. Use with separate sound or intercarrier. Has converter coil. 2½" shaft. Sale price, $7.95. Famous RCA 301E1, 12 channel tuner with 3-6J6 tubes. Brand new as used in RCA 630 chassis. Stock No. RCA-13P, Sale price, $7.95.

RC-42, 12 channel printed circuit tuner used in Hallicrafters. With 6J6 and 6C8G tubes. 6½" shaft. Sale price, $9.95.

GI-44 General Inst. 12 channel tuner with 6BC8, 6AG5 and 6J6 tubes. 3" shaft. 21 mc I.F. Sale price only $4.95.

# McGEE RADIO COMPANY

PRICES F.O.B. KANSAS CITY

SEND 25% OR FULL REMITTANCE WITH ORDER. BAL. SENT C.O.D.

OUR NEW ADDRESS IS

1901 McGEE St., KANSAS CITY, MISSOURI

# CUSTOM RADIO CHASSIS—CHANGERS—HI-FI SPEAKERS

## 17" TO 21" TELEVISION CABINETS—LESS THAN FACTORY COST!

### SPECIAL PURCHASE SALE!

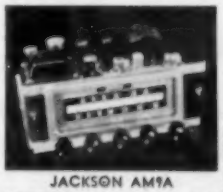


**CROSLEY FM-AM TUNER**

SALE PRICE **$19.99**

Model 363-2, 6 tube Crosley FM-AM tuner. Receives broadcast, 550 to 1600 kc and FM, 88 to 108 mc. Uses loop antenna for broadcast and has external antenna connections for FM antenna. Complete with tubes—6BA6, 6BE6, 12AT7 and 6V6. Power to operate this chassis is to be picked up from your present audio amplifier or television set. (6.3 volt filament and 125 to 160 volts at 30 mils "B" voltage required.) Chassis size, 8½" deep, 10¾" long, 5⅛" high. Has illuminated slide rule dial 8½" long and 1½" high. 4 position switch on front of chassis selects FM, AM, TV or Phono. Input jack for variable reluctance pickup on back of chassis. One-half of the 6T8 is used as a pre-amplifier for the variable reluctance input. Chassis has no volume control. Audio is fed into your television or Hi-Fi audio amplifier. These are new Crosley FM-AM tuners that cost the factory more than $20.00 to build. Model 363-2, shipping weight 9 lbs. Sale price $19.99. Complete with escutcheon, knobs, diagram, instructions and parts list.

Crosley 362-2VC, FM-AM tuner, same as above, but with volume control and power supply added to make a completely self-powered FM-AM tuner. Shipping weight 10 lbs. Sale price $24.99.



JACKSON AM9A

**9-TUBE HI-FIDELITY**

12 Watts Audio
Dual Tone Controls

**$39.95** LESS SPEAKER

**RECEIVES BROADCAST 550 TO 1650 K.C.**

Jackson Model AM9A, 12 watt high fidelity audio amplifier and broadcast tuner combined, at less than you would normally pay for the amplifier alone. Push-pull 6V6 output. Frequency response from 30 to 15,000 cps. Inputs for crystal or G.E. variable reluctance pickup and crystal or dynamic microphone. Separate bass boost and treble tone controls. Radio-phono switch on front of chassis. Shielded output transformer matches 3.2 or 8 ohm speaker. Heavy duty 190 mil power transformer. 9½" illuminated slide rule dial with etched glass scale. 3 gang condenser with tuned R.F. stage and loop antenna. Receives broadcast 550 to 1650 kc. Size 13" long, 6" high and 9½" deep. Complete with tubes: 2-6BA6, 6AU6, 6BE6, 6SN7, 6AT6, 2-6V6 and 6Y3. Knobs, escutcheon, diagram and instructions included.

Model AM9A, Hi-Fi amplifier and tuner. Ship. wt. 9 lbs. Sale price, $39.95
Model AM9A with our CU-14Y 12" coaxial PM speaker, both for $49.95.
Model AM9A with our P15-CR 15" coaxial PM speaker, both for $59.95.

### 11-TUBE FM-AM HALLICRAFTERS



HALLICRAFTERS S-78A

Regular $89.50
McGEE'S SALE PRICE **$69.95** LESS SPEAKER

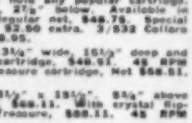
★ HIGH FIDELITY
★ AUTOMATIC FREQUENCY CONTROL

Hallicrafters Model S-78A, 11 tube FM-AM superhet custom chassis. Size 7⅞" x 12½" x 11" deep. Complete with tubes, knobs, escutcheon, diagram and instructions. Receives broadcast 540 to 1700 kc, plus FM 88 to 108 mc. AFC holds FM stations in perfect tune. Output transformer matches 3.2 ohm or 500 ohm. High fidelity response, 50 to 14,000 cps. Bass boost tone control. A full 11 tube transformer powered chassis with push-pull 6K6 audio. This chassis found in $400 to $600 radio combinations. Has input for crystal phono pickup. Self-powered preamplifier necessary for G.E. variable reluctance cartridge, $5.95 extra.

S-78A Hallicrafter 11 tube FM-AM chassis. Ship. wt. 22 lbs. ..... $69.95
S-78A Hallicrafter with our CU-14Y 12" coaxial PM speaker ..... $79.95
S-78A Hallicrafter with our P15-CR 15" coaxial PM speaker ..... $89.95

### GARRARD—COLLARO—WEBCOR 3-SPEED RECORD CHANGERS

**$65.00 LIST COLLARO 3/532 $38.95**



Here are top values in modern up-to-date 3 speed automatic record changers. New Webcor model 114-1, 3 speed automatic changer with RPX-050 G.E. cartridge. Size, 13½" x 12". Ship. wt. 12 lbs. Sale price only $29.95.

Regular $65.00 list Collaro model 3/532, 3 speed automatic record changer made in England. Intermixes 10 and 12" records of same speed. Constant speed 4 pole motor and weighted turntable with molded rubber mat. Compensating slug to shift weight of tone arm for LP and std. records. Plug-in head will hold any popular cartridge. 14¾" long, 12¼" wide and 4¾" above motor board, 2⅞" below. Available in grey, cream and gold hammertone. Ship. wt. 20 lbs. Regular sale $48.75. Special sale price, $38.98 less cartridge. Large 45 RPM spindle, $2.50 extra. 3/532 Collaro changer with G.E. Golden Treasure RPX-052 cartridge, $58.95.

RC-80 Garrard "Triumph," 3 speed automatic changer, 13½" wide, 15½" deep and 6" high, 2½" below motor board. Net price, less cartridge, $40.95. 45 RPM spindle $3.43 extra. RC-80 with G.E. RPX-052 Golden Treasure cartridge, Net $58.51. RC-80 with crystal flip-over cartridge, only $52.46.

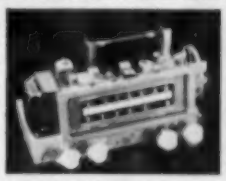
RC-90 Garrard "Crown," 3 speed automatic changer, 13½" x 15½", 5¾" above motor board and 2⅞" below. Net price, less cartridge, $48.11. With crystal flip-over cartridge, $72.06. With G.E. RPX052 Golden Treasure, $58.11. 45 RPM spindle, $3.43 extra.



**UHF CONVERTER TUNERS $2.95**

**3 FOR $7.50**

Take your choice of any of these three UHF converter tuners at $2.95 each, 3 for $7.50. (1) Mallory inductuner with 6AF4 and 1N78 diode. This is a complete UHF osc-tuner similar to the one used by Mallory in a converter and by many set manufacturers in their UHF TV sets. (2) CBS-Columbia single channel UHF converter intended for use in UH11 and UH12 CBS TV sets. Complete with 6AF4 tube, diode. (3) Small compact UHF converter tuning assembly with 6AF4 tube and diode. Many applications for this in UHF. Your choice of any of these for only $2.95 each, or 3 assorted for $7.50.



**HI-FI FM-AM TUNER AND 10 WATT P.P. 6V6 AMPLIFIER**

BOTH FOR **$49.95**



10 W. AMP.

9 TUBES-PLUS 2 RECTIFIERS PHONO INPUT

New, high fidelity self-powered FM-AM tuner with 10 watt amplifier (Push-pull 6V6's) on separate chassis. All you need is a record changer and one of the speakers shown below, to have a complete home music system. 3 ft. cable connects tuner to amplifier. Tuner has input for crystal phono pickup. (If one of the changers with a G.E. variable reluctance cartridge is purchased, we will include the necessary pre-amp at no extra charge). Self-powered tuner has 6 tubes plus rectifier (12AT7, 6BE6, 2-6BA6, 6AT6, 6AL5 and 6X4). Amplifier has 3 tubes: 2-6V6's, 6SN7, plus rectifier. Full superhet circuit with AVC and 3 position tone control. 9" illuminated slide rule dial with gold color escutcheon and matching knobs. Kit "High-Q" ferrite stick loop antenna for AM and separate FM antenna. Radio FM, AM, phono selector switch, tone control, volume control-off-on switch are on the tuner chassis. High fidelity response, 50 to 17,500 cps. Receives broadcast 540 to 1600 kc and FM, 88 to 108 mc. Output transformer will match any of the speakers listed below. This high fidelity FM-AM tuner and 10 watt amplifier is comparable with competitive units selling for $100.00 and more. Stock No. FAS-2CR, tuner and amplifier complete with all tubes, knobs, instructions and diagram. Ship. wt., 22 lbs. Special sale price, only $49.95. CU-14Y, 12" coaxial PM speaker, $10.00 extra. P15-CR, 15" coaxial PM speaker, $20.00 extra, when ordered with tuner-amplifier. Collaro 3/532, 3 speed automatic intermix changer with crystal flip-over cartridge, $42.95 extra.



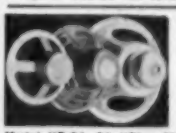
**McGee's Famous 12 AND 15 INCH COAXIAL P.M. HIGH FIDELITY SPEAKERS**

**$12.95** 12-Inch Model CU-14Y

**$23.95** 15-Inch Model P15-CR

Model CU-14Y, 12" high fidelity coaxial PM speaker. Response from 30 to 17,500 cps. Full 8.8 oz. Alnico V magnet in the 12" woofer. Special coaxially suspended high frequency tweeter. Built-in crossover network. Only two wires to connect to your radio or amplifier. Matches 3.2 to 8 ohm output. Don't confuse this speaker with many cheap speakers that are offered. This is a fine quality speaker. Stock No. CU-14Y. Sale price $12.95 each, two for $25.00.

Model P15-CR, 15" high fidelity coaxial PM speaker. Response down to 30 cps, and up to 15,000 cps. Full 21½ oz. Alnico V magnet in the 15" woofer. Specially made, coaxially suspended 5" high frequency tweeter. Built-in crossover networks. Only two wires to connect. Matches 3.2 to 8 ohm output transformer. A regular $62.50 list speaker. Model P15-CR, McGee's Sale Price, $23.95.



**HIGH FIDELITY SPEAKERS**

8" BLUE STREAK ..... $ 6.95
12" JENSEN P-12P ..... $15.95
15" WOOFER ..... $16.95

Model HF-8J, 8" "Blue Streak." High Fidelity wide range speaker. This one speaker properly baffled will give excellent response to both high and low frequencies and terrific response through the very important middle range. It has tone quality equal to many high priced imported speakers. Has 6.8 oz. Alnico V magnet with wide range curvilinear cone and 8 ohm voice coil. This speaker rates at 8 watts on low volume levels. 8 watts continuous with peaks up to 12 watts. Response essentially flat from 35 to 12,500 cps. Ideal for use with a woofer for a hi-fi speaker system. Perfect for hi-fi receivers, amplifiers and professional music systems. Ship wt., 6 lbs. Model HF-8J, Sale price, $6.95.

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$29.95 | $19.95 | NRT-21M $59.95 | BT-210 $22.95

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Fig. (c) No. AM-430, Mahogany with full doors, 24" high, 21⅝" wide and 20½" deep. Chassis area 22" w., 17⅝" h., 18½" deep. Blank panel. Holds 17" TV easily. Baffle cut for 10" speaker. Ship. wt. 80 lbs. Or sale at less than it cost a famous TV factory. Sale price, $29.95.

**17" with PHONO DRAWER $19.95**

Fig. (g) 55-21, 17" mahogany TV cabinet with phono drawer 40" h., 24" w., 18½" deep. Blank panel. TV chassis area 19" h., 30½" w. Changer drawer 19¾" wide, 13" deep. Baffle cut for 10" speaker. Ship. wt. 78 lbs. Sale price, $19.95.

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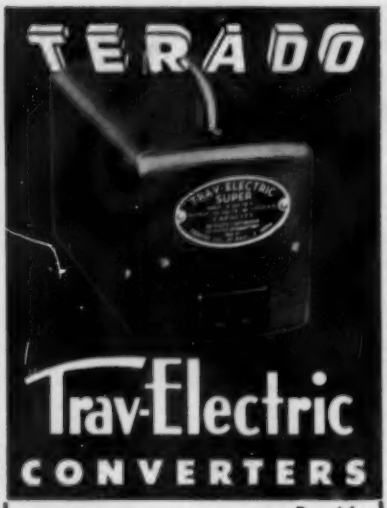
**21" BLONDE $22.95—MAHOGANY OR WALNUT $19.95**

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# A SIMPLE BIAS SUPPLY


By **BRUCE F. BROWN, W6TWW**
Chief Electronics Technician, USN

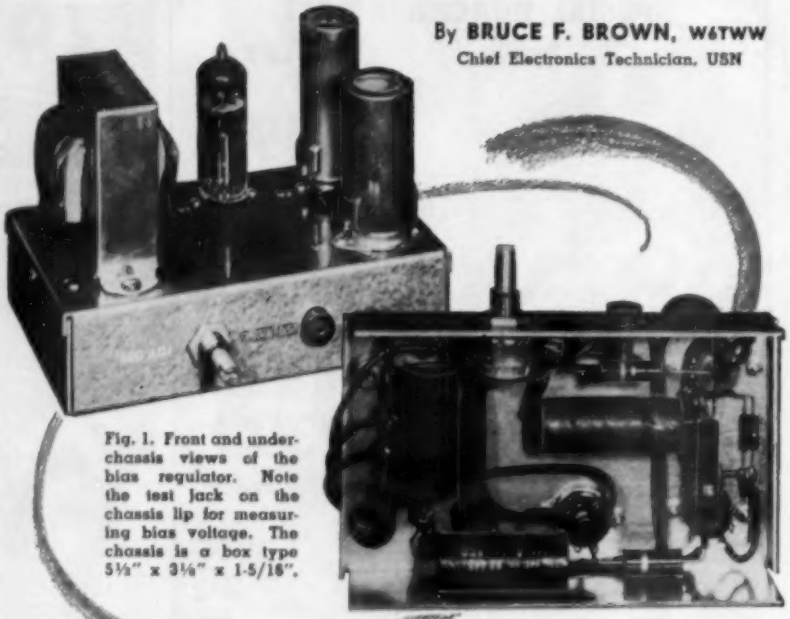
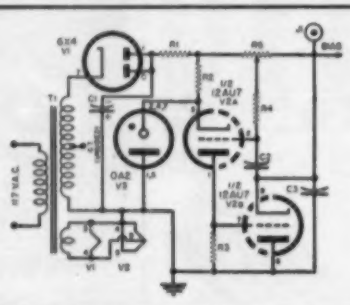



**Fig. 1. Front and underchassis views of the bias regulator. Note the test jack on the chassis lip for measuring bias voltage. The chassis is a box type 5½" x 3⅛" x 1-5/16".**

★ ★ ★

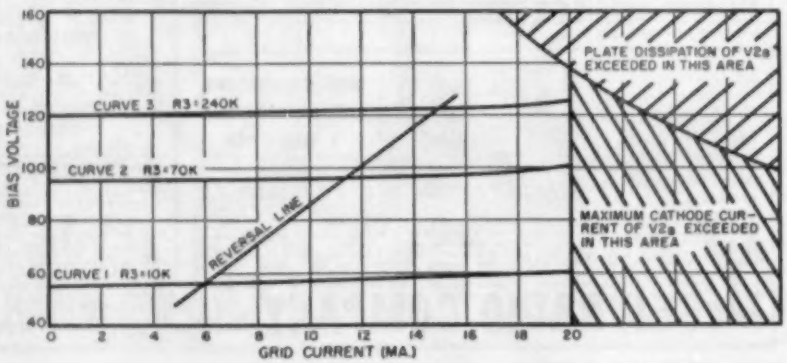
*Details on a shunt-type regulator that provides good regulation, is small in size, and is not expensive.*




$R_1$—8200 ohm, 2 w. res.
$R_2$—5000 ohm, 1 w. res.
$R_3$—68,000 ohm, 1 w. res. (see text)
$R_4$—100,000 ohm, ½ w. res.
$R_5$—500,000 ohm pot
$C_1$—4 μfd., 450 v. elec. capacitor
$C_2$—.25 μfd., 400 v. capacitor
$C_3$—15 μfd., 250 v. elec. capacitor
$T_1$—Power trans. 125-0-125 v. @ 25 ma.; 6.3 v. @ 1 amp (Stancor P58416 or equiv.)
$J_1$—Insulated phone tip jack
$V_1$—6X4 tube
$V_2$—12AU7 tube
$V_3$—0A2 tube

**Fig. 2. Schematic diagram of the bias regulator. It requires only five more components than a simple voltage regulator tube circuit and is inexpensive to build.**

**Fig. 3. Graph of final amplifier grid current plotted against grid bias showing that for normal operation the maximum plate dissipation and maximum cathode current ratings of the shunt regulator are not exceeded. For full details, see text.**



RECENTLY, the need for 95 volts of well-regulated bias arose during the conversion of a push-pull class C amplifier, employing a pair of 813's, to a push-pull class B linear amplifier for single sideband.

The nearest value of regulated bias obtainable from a voltage regulator tube was 90 volts. Therefore, it was decided that a shunt-type electronic regulator would be designed and constructed to supply the desired bias.

This shunt-type regulator had to meet three requirements: good regulation within its range of operation, small size for installation in the existing transmitter with a minimum of equipment modification, and reasonable cost.

This regulator has few components (only five more than a simple voltage regulator tube circuit), requires very little filtering, and is simple. Cost of the few extra parts is partially offset by the reduced cost of filter components.

The grid current drawn by the 813's on voice peaks is small so it is unnecessary to use bulky and expensive tubes, such as the 6AS7G, for regulation of the bias voltage. Accordingly, a circuit using a miniature-type tube was developed.

The regulator, as shown in Fig. 1, provides a useful output voltage range from 50 to 125 volts at grid currents up to 20 milliamperes. Since this range is considerably in excess of the requirements of the 813's the unit is usable with any other tube, or tubes, in a linear amplifier in which the grid current and grid voltage requirements are within its capabilities.

The unit is designed for optimum regulation at 95 volts output. However, for best regulation of other output voltages, within its range of operation, a change in the value of $R_5$ is required. This change will be explained later.

The circuit is shown in Fig. 2. $V_1$ provides half-wave rectification of the entire high voltage secondary of $T_1$ and delivers 200 v. of partially filtered d.c. to the top of $R_2$ and $R_3$. $R_1$ serves to assist the filtering action and, due to the low current drain on the rectifier, is used instead of a filter choke. A fixed negative reference potential of 150 volts is provided by $V_2$ at the cathode of $V_{2A}$. This is the regulator control tube. It controls the bias on the shunt regulator, $V_{2B}$. The regulated bias voltage is developed across the cathode-to-plate resistance of $V_{2B}$; the potentiometer, $R_5$, is used to set this bias to the desired value.

To follow the sequence of regulation, assume that the grid current flowing in the biased amplifier is increasing. This grid current flows to ground through the shunt regulator, $V_{2B}$, and tends to increase the bias voltage due to the tube's internal resistance. Any increase in the bias voltage is coupled, in part, through $R_3$ and $R_4$ to the grid of the control tube, $V_{2A}$, and causes its conduction to decrease.

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$R_3$ produces a decrease in bias on the shunt regulator, thereby lowering its resistance and tending to maintain the bias voltage at a constant level.

Capacitor $C_2$ supplements the filtering action by coupling ripple voltage or transients, in full amplitude, to the grid of the control tube. This makes the filtering action so effective that $C_2$ can be reduced to .5 μfd. and the output ripple voltage will be only *.3 volt peak-to-peak!* However, if $C_2$ has too much leakage, regulation at higher voltages will be impaired by its shunting effect on $V_{2B}$.

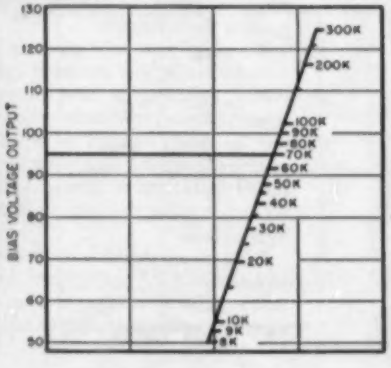
Plotted in Fig. 3 is a family of curves illustrating the regulating ability of the unit. Curve 2 denotes a one-volt change in bias at a grid current of 12 milliamperes. This indicates that the unit is the equivalent of a constant voltage generator in series with a resistance of 83 ohms. This effective internal resistance will increase slightly at higher and lower output voltages.

When the grid current flow from the biased amplifier stage swings to the right of the "reversal line" (see Fig. 3) the grid of the shunt regulator, $V_{2B}$, *swings positive with respect to its cathode.* The grid current drawn by $V_{2B}$ causes some curvature in the regulation characteristic to the right of the "reversal line." Although the unit is intended for use at currents up to the "reversal line," it may be used to the maximum current of 20 milliamperes if less exact regulation can be tolerated.

As previously mentioned, a change in the value of $R_3$ is required in order to maintain optimum regulation at different output voltages. The correct value of $R_3$ may be determined from Fig. 4 and is 70,000 ohms for 95 volts of bias. Since 70,000 ohms is not a standard RETMA value, 68,000 ohms was substituted.

As with most regulated power supplies, the output voltage will change if the power line voltage varies. The variation in output with sustained line

**Fig. 4. Chart showing optimum value of $R_3$ vs bias voltage for best regulation. To determine $R_3$, when the desired bias voltage is known, follow horizontally from bias voltage scale to resistance scale. The point of intersection on the resistance scale gives the optimum value of $R_3$. From the chart it was determined that $R_3$ must be 70,000 ohms for 95 volts of bias output. A 68,000 ohm unit was used.**





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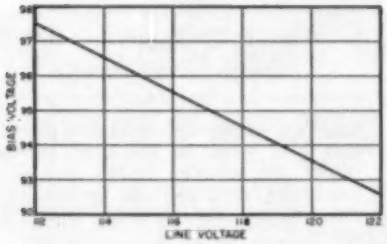



**Fig. 5. Graph showing the variation in bias caused by changes in the line voltage.**

voltage change is illustrated in Fig. 5. The use of a 15 μfd. capacitor at $C_3$ smooths out most output voltage variations caused by non-sustained fluctuations in line voltage, *i.e.*, those due to the high current drawn by the transmitter on voice peaks.

In the event that line voltage regulation is very poor, satisfactory regulation may not be obtained when a high power transmitter is used. This may be corrected by replacing $R_3$ with an 0B2 voltage regulator tube. In addition, it will be necessary to use a transformer that has higher secondary voltage in place of $T_1$.

In short, the unit described is capable of providing good regulation of bias voltage at small grid currents, is inexpensive, and is small enough to install in the majority of transmitters without extensive modification of the equipment.

The views and opinions expressed by the author are his own and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large. —30—

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## R/C Receiver

(*Continued from page 65*)

leads are soldered directly into the circuit. All wires to and from the receiver are soldered to the pins of a miniature connector to permit easy removal of the receiver from the model.

Adjustment of the receiver is very simple. Before applying power to the receiver, be sure $R_2$ is set for maximum resistance. This is very important because too low a value of plate resistance could damage the RK61. After applying power, touch the probe of a high impedance or vacuum-tube voltmeter to the plate end of $R_2$ and tune the coil and antenna trimmer to obtain the highest voltage possible. With the antenna and coil tuned, decrease $R_2$ until the relay opens. $R_2$ should be set at the maximum resistance at which the relay will remain open because the lower the plate current, the slower the RK61 will age. The transmitter should be removed as far from the receiver as possible during the tuning operation. Every ten or twenty hours as the RK61 ages the resistance of $R_2$ will have to be reduced to maintain sufficient noise output.

As important as a good receiver, is a reliable rudder actuating mechanism be it in a boat or an airplane. Again, the mechanisms most generally in use are inadequate. Most of them fall into the escapement category where power is supplied by springs or rubber bands. An escapement device similar to that used in a clock is pulsed by the receiver relay. So many pulses give a right turn and so many give a left turn. But if the operator happens to forget what position the escapement is in or if the receiver misses a pulse, disaster may occur before the situation can be righted. So, the first requisite of any rudder control mechanism is that it be self-neutralizing, that is, it must return automatically to neutral after the execution of a turn. Any escapement driven by springs or rubber bands can perform only a limited number of turns before losing power. Here again the operator might exceed his allotment with disastrous results. Therefore, the second requisite of a control mechanism is that it be capable of performing an unlimited number of turns.

The rudder-control device is a motor driven, self-neutralizing control. A small, three-volt motor drives a 1½ inch diameter cam through a 256:1 gear ratio. The cam, in addition to supplying power to the rudder, operates a simple switch that sequences the operation of the unit. The switch can exist in one of three possible conditions. Over the rise on the cam, only the center and upper contacts are closed. On the surface of the cam all three contacts are closed, while in a flat of the cam only the center and lower contacts are closed. Power to

run the motor is fed from the receiver relay to the upper and lower contacts of the switch. If the receiver relay is open (transmitter off) the motor will turn the cam until the rise opens the center and lower contacts, whereupon the motor will stop the cam in the neutral position; hence, self-neutralization. If a right turn is desired, the transmitter is keyed on. The receiver relay closes and power is then applied to the motor through the upper contact. The motor will turn the cam until a flat opens the center and upper contacts, whereupon the motor will stop the cam in the right turn position. The cam will remain in this position until the transmitter is keyed off and then it will automatically neutralize. A left turn is accomplished simply by turning off the transmitter long enough to allow the first flat of the cam to pass under the switch contacts. Since the cam makes one complete revolution in about two seconds, the timing is not critical and a little practice is required to obtain perfection. Obviously, the transmitter used with the system should have push-button keying.

If the motor is allowed to run without load, inertia will carry the cam past the rise and flats. A small piece of tin can be attached to the shaft of the motor to slow it with a fan action. While this limits the speed of the motor it doesn't seriously affect the power of the motor.

The cam is machined from a piece of soft steel and the rise is created by brazing a glob of brass to the surface and filing it to the proper contour. The cam is about the only part of the mechanism that cannot be made with ordinary hand tools, and even it, with care, can undoubtedly be filed to shape by hand. The gears can be purchased in any hobby store. The entire mechanism weighs six ounces and develops about ten inch-ounces of torque. Weight can be reduced by substituting aluminum for the cam. The switch contacts were taken from an old relay. Two ordinary flashlight cells will operate the unit intermittently for many hours because the motor consumes only 500 milliamperes at three volts. The model boat in which this unit is installed uses a six-volt storage battery for propulsion power, and to eliminate additional batteries, a small rheostat is used to drop the voltage to three volts from the main storage battery.

The opening of the 27.255 megacycle Citizens band has at least doubled the number of radio control enthusiasts in the past couple years. While the equipment described here is certainly not the only remote control equipment that operates with reliability, it operates more reliably than most of the equipment in use. With care and patience in construction you can construct a radio-controlled model with complete confidence that it will give you the gratification that it should. Best of luck and have fun! —30—


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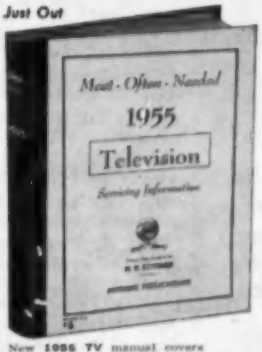
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Export: Morhan Exporting Corp., New York, N. Y.
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*DUPONT'S NEW SUPER STRENGTH FILM.


## Time for Portables

(*Continued from page* 45)

replacement. Making a list of the troubles found and actually pointing them out to the customer will usually result in your getting the job of putting the set back in proper shape. You can work out a deal where the initial inspection charge is absorbed in the final service charge, but make it plain to the customer that the inspection charge is to be paid for examining his radio, whether or not he decides to have the required repairs made.

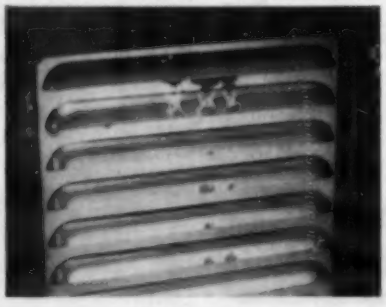
After you have inspected one of these jobs, always clean the dust off the chassis and polish the cabinet a bit. It takes only a minute or two, but it certainly pays off in good-will as it shows the customer that you take a personal interest in his property. (Polishing off major rust spots, such as those shown on the grille in Fig. 9, would take time and effort and should not be attempted unless it's part of the job.) If the external appearance of the set appears the same as when he brought it in to you, there might be a question in his mind about just what you did do to his set.

### Getting the Business

This brings us to the final, but by no means least, point in our discussion. How to go about getting the business. A sign in your window is one method. Handbill throwaways or an ad in the local paper are others. However, your biggest drawing card can be your own window.

We have already referred to the use of dummy batteries to boost your battery sales, but your whole window, or a substantial part of it might be dressed with the accent on portable radios. Use the manufacturers' posters, signs, and streamers, and put a portable radio chassis into your window connected up to a spare meter to accent the repair feature. Build your display as attractively as you can and make the best use of your attention stoppers to get people to look into your window. All this combined with pleasant and efficient service will insure your getting a greater amount of the portable radio repairs in your community. —30—

**Fig. 9. Bad corrosion on a metal speaker grille such as shown here, is difficult and time consuming to eliminate.**




*Among important activities at Hughes is a program involving comprehensive testing and evaluation in connection with Hughes-developed radar fire control and navigation systems for latest type military all-weather interceptors.*



Convair F-102 all-weather interceptor.

# System Test Engineers

There is need on our Staff for qualified engineers who thoroughly understand this field of operation, and who have sufficient analytical and theoretical ability to define needed tests; outline test specifications; assess data derived from such tests, and present an evaluation of performance in report form.

*Engineers who qualify in this area should have* **1** *a basic interest in the system concept and over-all operation of test procedures;* **2** *experience in operation, maintenance, "debugging," development, and evaluation testing of electronic systems, and knowledge of laboratory and flight test procedures and equipment;* **3** *understanding of basic circuit applications at all frequencies;* **4** *initiative to secure supporting information from obscure sources.*

# Hughes

RESEARCH AND DEVELOPMENT LABORATORIES

SCIENTIFIC AND ENGINEERING STAFF

*Culver City, Los Angeles County, Calif.*

# Sales Aids

### 3-D SLIDES OF LINE

*Trav-Ler Radio Corporation* of Chicago is using 3-D color slides and 3-D stereo-viewers as a means of introducing its 1955 line to its distributors.

The idea is to present the merchandise to the distributors in such a way that the distributors could clearly visualize all of the features of the firm's line of TV sets, radios, clock radios, and phonographs.

### LITTELFUSE DISPLAY

*Littelfuse, Inc.*, 1865 Miner St., Des Plaines, Ill., is now offering a versatile display card to its jobbers.

The black and yellow card, featuring the company's logo, is marked on the back for proportional trimming, thus




the 24-in. x 30-in. card can be trimmed down to 20¼ in. x 20 in. for use where space is at a premium.

The cards will be given to jobbers by the company's representatives.

### ANTENNA MOVIE

*Channel Master Corporation* of Ellenville, N. Y., has produced a full-color 30-minute film entitled "Up She Goes!"

The film presents information about TV antennas and accessories never before filmed, according to the company. It will be shown to TV dealers and installation men at a series of TV installation clinics which will be sponsored and conducted by the firm's distributors throughout the country.

The film covers antennas, rotators, masting, and couplers. The presentation is designed to help the dealer take advantage of every profit-making opportunity by informing him of today's latest time-saving, labor-saving installation techniques.

The film will also be available on loan to radio and television schools and other educational institutions.

### COUNTER DISPLAY CARD

The *Regency Division* of *I.D.E.A., Inc.*, 7900 Pendleton Pike, Indianapolis 26, Ind., has released a counter display card to its jobbers to display its Model TR-1 transistorized radio receiver.


your KEY TO EXCELLENCE

phaostron

"555"

metal-cased MULTIMETER




POCKET SIZE WITH A 4⅞" LENGTH SCALE

an instrument of *PERMANENT ACCURACY*

in a case that *WON'T BREAK*

- ✓ AC CURRENT RANGES
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- ✓ 3% DC, 4% AC PERMANENT ACCURACY

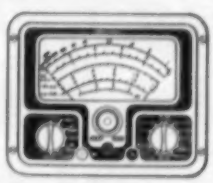
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GENUINE LEATHER CARRYING CASE $5.95





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"555" MULTIMETER

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*Quality Designed by*
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Owners of the Marantz Audio Consolette invariably comment on the immediate improvement in sound quality of their systems. Such a fine instrument cannot be produced by the thousands, but only through careful assembly and thorough testing of each unit.

Naturally, its components are uncompromisingly chosen for superior quality. This and the character of its workmanship makes it the obvious choice for those who wish to improve their present installations. Chassis suitable for installation $142.50, with cabinet $155.00.

*Write for Complete Details* **s. b. marantz** 44-15 Vernon Blvd., L.I.C., New York

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Changes dull eye-straining black and white pictures into beautiful color tones. Seconds to attach. No tools used. Helps eliminate glare. Order direct. Send $1 for screen size up to 16", $1.25 size 17", $1.50 size 20", $2 size 21", $2.50 size 24", $3 size 27". We pay postage except on C.O.D. orders. Satisfaction guaranteed. Inquiries from dealers also welcomed.

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| 17BP4A | 27.50 | 16EP4A | 23.50 |
| 17BP4B | 29.75 | 16QP4 or A | 21.00 |
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| 17CP4B (Aluminum) | 28.50 | 17CP4A | 21.00 |
| 19AP4A | 29.75 | 17CP4B | 23.60 |
| 20CP4 | 30.00 | 19FP4 | 23.00 |
| 20LP4 | 27.50 | 19FP4A | 23.00 |
| 21AP4 | 30.75 | 19AP4 | 23.50 |
| 21EP4 | 31.80 | 19AP4A | 34.90 |
| 21RP4A | 38.35 | 20CP4 | 23.50 |
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Modern styled cabinet. IVORY—$14.25. RED & BLUE..... $13.95

**6 x 9 REAR SEAT SPEAKER KIT**
Includes: 6x9 speaker, grille, mtg. screws, switch, bracket and wire. List $9.95. SPECIAL ..... $4.82

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| SPICO-88—Indoor Antenna ..... | 2.19 ea. |
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We also carry a complete line of popular makes of Radio Tubes at 50/10 discount. Also many other special purpose and transmitting types, and all electronic parts and equipment at lowest prices. Send us a list of your requirements for prompt quotations. Terms: 20% with order. Balance C.O.D. All prices F.O.B., NEW YORK Warehouse. Minimum order $5.00. Write for our latest price list and HI-FI catalog to Dept. RN-5.

**STAN-BURN** RADIO and ELECTRONICS CO
1697 BROADWAY • NEW YORK 19, N.Y.


The card comes in sturdy cardboard and has a space in which to fit one of



the units. The set itself comes in red, ivory, black, or grey and adds an effective color note to the display.

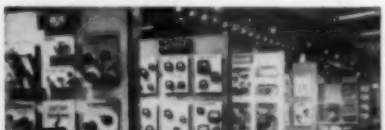
### COUNSELING SERVICE

In a concerted drive to develop individual markets within distributorships through personal distributor counseling in advertising and sales promotion, *General Electric Company's* radio and television department in Syracuse, N. Y., has set up a series of round-table discussion meetings which will be attended by representatives of the company's distributors and by the department's district sales force.

Led by Marcus S. Chacona and Raymond Mann, advertising specialists, the information gathered at these meetings will be a strong factor in future cooperative advertising and sales promotion schedules. Each distributor will be shown a survey of his individual market area, including such information as national advertising circulation, primary and secondary newspaper coverage, radio and television listening areas, etc.

### ALLIED'S "VISI-DEX"

*Allied Radio Corporation,* 100 N. Western Ave., Chicago 80, Illinois, has set up a unique visual index of its various electronic units in its huge Chicago showroom.



The items displayed are changed frequently, allowing customers to see and measure some of the 25,000 items in this distributor's stock.

### PENTRON SALES AIDS

*The Pentron Corporation, 777* South Tripp Avenue, Chicago 24, Ill., is backing up the sales effort behind its new "Monomatic" Model CT-1 tape recorder by making available a group of specially-planned sales aids.

Included in the group of sales aids are die-cut, 2-color counter cards and

## BEACON RECEIVER



BC-1206 CM—200-400 KC., Setchell Carlson, operates from 24-28 VDC, 8 Tubes, 238 KC IF —Size: 4" x 4" x 6". Boxed. W/Man. NEW: **$11.95**

## 6 VDC VIBRATOR POWER SUPPLY



RCA MJ-8—6 VDC input; output 275 VDC 80 MA w/024 Tube, 11 Ft. Batt. & Power Cable, Switch & Fused Line. 4½" x 4" x 6".....NEW: **$7.95**

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115 VOLT 60 CYCLE. Synchronous Transmitter C-78414. 5" x 3½". Long Leads w/Bracket Removed from New Equip. PAIR: **$15.00**

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Tubular steel, copper coated, painted in 3 ft. sections, screw-in type. MS-53 can be used to make any length with MS-52-51-50-49 for taper. Any section ..... @ 50¢ Each
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250-0-250 VAC—80 MA. 24 V. 1 A.; and 6.3 V. 1 A. #H-109—Price..... 3.95

CURRENT TRANSFORMER—Ratio 150 to 5; 25 to 60 cycle. West. Style 81R581..... $8.95
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Choke 12Hy/250 MA., 100 Ohm..... 4.95
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## RECEIVER—TRANSMITTER:

BC-229/429—RECEIVER TRF—With 3 Plug in Coils for Freq. 201 to 398; 2500-7700 KC; Six Tubes: 1/37—1/38—3/39. Size: 16" x 8" x 7". With Schematic. Price. USED: **$6.95**

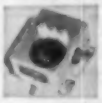
BC-230 TRANSMITTER—Voice modulated, with 5 Plug in Coils for Freq. 2500 to 7700 KC. Four Tubes: 2/10y—2/45 & 0-1.5 RF Meter. Size: 13" x 8" x 7". With Schematic. Price..... USED: **$8.95**

PLUGS to fit BC-229 or BC-230.....Each: 75¢
CONTROL BOX F/BC-229 or BC-230..Ea.: 75¢
TUNING KNOBS F/BC-229 or BC-429..Ea.: 65¢
COILS F/Rec. 201-398; 2500-4150; 4150-7700. Each: $1.75
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SET of 5 Coils..... $5.00

## TRANSMITTER & AUTOMATIC KEYER



TRANSMITTER T-121—3.5-4 MC; 50 Watt Crystal Control MO. P.A. for CW. W/2-1625, 1-25L6 Tubes & Crystal. Keyer consists of 24 VDC Keyer Ass'y. & Code Wheels. Size: 8½" x 6⅝" x 9½" w/Instruction Book. NEW: **$9.95**



## ANTENNA RELAY UNIT

—BC-442 consists of switching relay, 0-10 RF Indicator, & 50 MMF Vacuum Capacitor...NEW: **$3.95**

## COAXIAL CABLE & CONNECTORS

CD-1671 CORD—With PL-259 Plugs each end, 50 ohm coax 2 Ft. long. Prices: 59¢ Each—Or in Lots of 10 @ 50¢ Ea.
PL-259—Plug. Ea. End & 32"—RG-54/U—50 ohm .50¢
SO-239 Chassis Conn. f/PL-259 (Removed)..3 for $1.00
UG-21/U—Plug ea. end & 32"—RG-11/U—75 ohm .50¢
UG-22/U—With 4" Coaxial Cable..... 50¢

| COAXIAL CABLE: Price Per Ft. | 100 | 500 | 1000 |
|---|---|---|---|
| RG-8/U $1.5 Ohm (Special) | .07 | .06½ | .06 |

RG-34 71 Ohms—145 Ft. Length.....$15.00 Per Lgth.

## BC-375 TRANSMITTER And TUNING UNITS

BC-375 100 Watt TRANSMITTER—Voice CW—Freq. 200-500 KC., 1500-12500 KC. by use of plug in Tuning Units. Uses 1/10y & 4/VT-4C Tubes. Size: 23" L. x 21" H. x 8" W. Complete with Tubes, less Tuning Units—Price.....USED: **$29.95**

TUNING UNITS For BC-375 & BC-191:

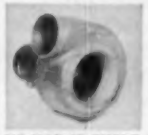
| | NEW: | USED: |
|---|---|---|
| TU-5—1.5 MC to 3MC | $5.95 | $4.95 |
| TU-6—3 to 4.5 MC | | 3.95 |
| TU-7—4.5 to 6.2 MC | 3.95 | 2.95 |
| TU-8—6.2 to 7.7 MC | 3.95 | 2.95 |
| TU-9—7.7 to 10 MC | 3.95 | 2.95 |
| TU-10—10 to 12.5 MC | 3.95 | 2.95 |
| BC-306 Antenna Tuner | 3.95 | 2.95 |
| CABLES PL-64-61 or PL-59 Each End....Each: | | 2.75 |

## ANTENNA MATCHER



VARIABLE INDUCTANCE TUNER with Calibrated Veneer Lock Dial. 100 Watt Capacity. (Pictured at left.) Size: 7½" x 3½"..... USED: $9.95
UNIT with 0-8 RF Meter and Panel. (Removed from BC-375) USED: $12.95

## BLOWERS:



12/24 VDC-AC CAST ALUMINUM BLOWER—100 CFM: 3" intake; 2" outlet. Shunt Motor 4" x 2". 3000 RPM @ 24 VDC..... **$5.95**

115 VAC 60 CYCLE SINGLE TYPE—100 CFM: 2½" intake; 2" outlet. Complete Size: 5" x 6". No. IC939..... **$8.95**

115 VAC 60 CYCLE DUAL TYPE—100 CFM: 4" intake; 2" Dia. Each Side. Complete Size: 8" x 6". No. IC880..... **$13.95**

115 VAC 60 cycle COMPACT TYPE—105 CFM: Motor built inside squirrel cage; 4½" intake; 3⅝" x 3" Dia. Complete size: 4⅛" W x8⅝" H x 8⅛" D—No. 2C067 ..... **$14.50**

115 VAC 60 cycle FLANGE TYPE—140 CFM: 3½" intake; 2½" Dia. Complete size 7½" W x 7½" H x 6⅝" D—No. IC907 ..... **$13.95**

115 VAC 60 cycle FLANGE TWIN—275 CFM: 4½" intake; 3½" x 3" Dia. Complete size: 11½" W x 8½" H x 8-1/16" D— No. 2C855 ..... **$21.95**

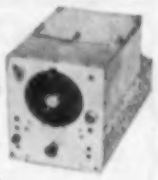
115 Volt 400 cycle—10 CFM. Eastern Air Devices Motor J31A—7200 RPM: 1/100 HP. L-R #2 Blower Assy. Overall Size: 4½" x 3½". No. 3110..... **$5.95**

### 115 VOLT 60 CYCLE BLOWERS:

6VDC SINGLE—100 CFM—No. 6100..... $4.95
6 VDC FLANGE—190 CFM—No. 6150..... 6.95
12 VDC SINGLE—10 CFM—Min.—No. 1210..... 7.95
24 VDC SINGLE—10 CFM—Min.—No. 2410..... 5.95
24 VDC DUAL—20 CFM.—Min.—No. 2420..... 7.95

RT-34/APS-13—Transcvr.—Comp. less Tubes..U: 2.95
FL-8A Range Filter—$1.49—FL-5 Filter.....U: 1.00
TS-9 Carbon Handset—U: $3.95—TS-13 Handset.U: 6.95

## BROADCAST BAND RECEIVER



NAVY/TYPE—530 to 1500 KC..NEW: **$24.95**

NAVY TYPE REC.—1.5 to 3 MC. Less Tubes USED: $ 9.95
NAVY/TYPE REC.—6 to 9 MC. Less Tubes USED: 3.00
BC-455 REC.—6 to 9 MC. With Tubes ..... USED: 4.95
R-28/ARC-5 REC.—100 to 156 MC. With Tubes USED: 14.95

## BC-221 FREQUENCY CASE



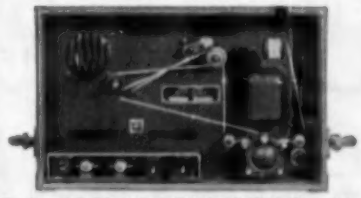
BC-221 FREQ. CASE—Aluminum Case for BC-221 or TS-186 Freq. METER—W/Voltage Regulator Supply using 1/VR-105—2/Ballast Tubes, Relay, Cable, etc. Front Comp. 8⅝" x 7½" x 7⅝", Rear Compartment 2" Deep. Shock-mounted..NEW: **$5.95**

## DYNAMOTORS:

| INPUT VOLTS: | OUTPUT: VOLTS: | MA. | STOCK No. | PRICES: USED: | NEW: |
|---|---|---|---|---|---|
| 14 VDC | 230 | 90 | DM-31 | $6.95 | |
| 14 | 330 | 150 | BD-87 | 3.95 | $5.95 |
| 14 | 250 | 90 | DM-29 | 6.95 | 9.95 |
| 14 | 1000 | 350 | BD-77 | 14.95 | 29.95 |
| 14 | 500 | 500 | BD-500 | | 12.95 |
| 14 | 600 | 300 | BD-86 | | 12.95 |
| 14 | 1030 | 250 | | | |
| | 515 | 215 | DM-42 | 8.95 | 12.95 |
| 28 | 1000 | 350 | PE-73 | 5.95 | |
| 12 or 24 | 500 | 50 | UBA/0515 | | 4.95 |
| 12 or 24 | 275 | 110 | USA/0516 | | 4.95 |
| 12 | 230 | 90 | PE-133 | 4.95 | 6.95 |
| 14 VDC | 375 | 150 | BD-83 | 3.95 | 4.95 |

## TG-34A KEYER

*NEW—$16.95*



TG-34A KEYER—115 or 230 V. @ 50 to 60 cycles—an automatic unit for reproducing audible code practice signals previously recorded in ink on paper tape. By use of the self contained speaker, the unit will provide code practice signals to one or more persons—or provide a keying oscillator for use with a hand key. Unit is compact, in portable carrying case, and complete with tubes, photo cell, and operating manual. Size: 10-9/16" x 10½" x 15-13/16". Shipping weight: 45 lbs. NEW—While They Last— ONLY ..... **$16.95**

TG-10 KEYER—Same function as TG-34A described above—only larger—Using 2/6N7, 2/6L6, 2/6H7, & 1/5U4G Tubes and 1/931 Photo Cell. Housed in standard Metal Cabinet, can be removed for 19" rack mtg. Size: 11" H x 24" W x 18½" D. Price—USED—TESTED.....Only **$17.95**

## METERS:



**WESTON AC AMMETER:**

(Pictured) In portable leather case, with Test Leads, 2½", 0-15 AC and 0-3 AC Scale..... **$5.95**

DC AMMETER HOYT: In portable metal case, with Test Leads, 4½", Fan, Mirrored Scale 0-15 ADC..... $4.95
0-3 RF AMMETER 1B-128; 2½" Rd....NEW: 2.95
0-500 MICROAMMETER: TRIPLETT, 2½" Sq.. 4.95
0-5 MA DC WESTINGHOUSE; 2½" Sq..... 3.95
DB METER: 10 to Plus 6—G. E.—3½" Rd..... 4.95
TS-291/U VOLTOHMMETER..... NEW: 7.95
0-8 Amp RF w/Thermocouple 1B-80; 2½" Rd... 4.95
0-15 AC-DC—2½" Rd.; 1B-122..... 4.95
0-500 MA DC—2½" Rd.; 1B-22..... 4.95

## CLASSIFIED

BC-459 Transmitter—7 to 9 MC..... Used: 8.95
BC-645 Transceiver—Conv. 420 to 500 MC. New: 24.95
BC-654 Transceiver—3000 to 5000 KC.... Used: 34.95
BC-709 Amplifier Batt. Op. 4 Tube—W: $2.95; U: 1.95
R-1/ARR-1 Receiver—Conv. 2 or 6 Meters..New: 5.95


**FAIR RADIO SALES** 132 SOUTH MAIN ST. LIMA, OHIO

**ARKAY** WORLD'S FINEST KITS
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TEST EQUIPMENT HI-FI
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"CUSTOM MODEL" RADIO ONLY $9.98
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# U.S. CRYSTALS MAY SPECIALS!

**RK-65 SINGLE SIDE BAND**



**"SLEEPER" 500 W. CARRIER RAYTHEON TETRODE TRANSMITTING TUBE**

Ideal for use in grounded grid circuit. Requires only 6 W. grid driving power. Operates similar to 4-250A. (See Radio Ham Book for complete details.) Guaranteed. Brand new. Original box. Shipping wt. 3 lbs. ..... **$9.95**

**CONDENSER SPECIALS!**

2 MFD. 6,000 V. CONDENSER. Used. Ea. .... $6.95
2 MFD. 5,000 V. CONDENSER. G.E. Pyranol. BRAND NEW. Each ..... $8.95

**PLATE TRANSFORMER**

American Trans. No. INPUT 115 VAC, 60 cycles, 525 KVA. PRI. 2240/1160 V. SEC. 500 MA. **$14.95**
Brand new! Special! Shipping wt. 60 lbs.

**SENSATIONAL PACKAGE OFFER OF 3 RECEIVERS COMPLETE WITH TUBES & DYNAMOTORS!**

| 75 MC RECEIVER | COMMAND RECEIVER | ARC-5 RECEIVER | ALL THREE RECEIVERS |
|---|---|---|---|
| Used, clean. Ship. wt. 14 lbs. Ea. $4.95 | 6-9 MC. With tubes, used, good cond. Wt. 10 lbs. Ea. ..... $4.95 | 3-6 MC. Less dial plate. Ship. wt. 10 lbs. Used, clean. Ea. ..... $4.95 | (Wt. 40 lbs.) ONLY ..... **$9.95** |



**LELAND ELECTRIC MOTOR**

Complete with Reduction Gear Box; reduces to approx. 60 R.P.M. Motor Rating 110 / 220 V AC 60 Cycles, 1725 R.P.M. ¼ h.p. BRAND NEW. Wt. 60 lbs. **$29.95**

**UNIVERSAL ELECTRIC MOTOR**

Series Wound—1/40 H.P., 28 V DC, 1.2 Amps. 6,000 R.P.M. ¼ inch shaft extends out ½ inch. Will also operate on AC—BRAND NEW! A terrific buy at only ..... **$1.49**



Wt. 5 lbs.

**TUBES!** New and Guaranteed

| | | | | | |
|---|---|---|---|---|---|
| Eimac 35TG Ea. | $2.95 | 6CP1 | $2.95 | ANY 2 TUBES | $5.00 |
| VT-127A | 2.95 | 75P7 | 2.95 | | |

**COMMAND EQUIPMENT**

**THE FAMOUS "Q-Ser"** 190-550 KC. With tubes. Used, good condition. Wt. 10 lbs. ..... **$10.95**
**3-6 MC.** With tubes, less dial. Used, good condition. Wt. 10 lbs. ..... **$7.95**
**6-9 MC.** With tubes. Used, good condition. A hot buy! Wt. 10 lbs. ..... **$4.95**
**BC-456 MODULATOR.** With tubes, good condition. Reduced! Wt. 20 lbs. ... **$3.45**

**CODE PRACTICE TAPE. NEW!**

REELS NO. 6, 10, 11, 18, 14. EACH ..... **$1.25**
PACKAGE DEAL: ALL 5 REELS (Wt. 7 lbs.) ..... **$4.95**

**COMBINATION POWER SUPPLY BRAND NEW—POWER TRANSFORMER**

Complete Shielded Hermetically sealed. Input 117 V AC, 60 Cycles. Output 660 V CT @ 85 MA; 5 V @ 2 Amps.; 6.3 V @ 7.5 Amps.; 6.3 V @ 0.3 Amps.

**DUAL FILTER CHOKE**

To match above transformer . . . 9.4 H. @ 85 MA.

**BOTH UNITS $2.95**

SHIPPING WEIGHT 20 lbs.

See our full page ad on Packaged and Individual CRYSTALS. This issue, Page 77.

NOTE: All orders must be accompanied by check, cash or money order with payment in full. No C.O.D. California buyers: Add sales tax. Check your postal zone and add sufficient postage. For items weighing more than parcel post limit (20 lbs.) shipment will be made via railway express freight collect.

**U. S. CRYSTALS, INC.**
805 S. UNION AVENUE
LOS ANGELES 17, CALIFORNIA



NEW! EICO

# FLYBACK & YOKE TESTER KIT



MODEL 944

LOWEST PRICED KIT $23.95 Wired $34.95

**Checks *all* flybacks & yokes *instantly*—in or out of set!**

- **Detects even 1 shorted turn!**
- ***Exclusive* separate calibration for air & iron-core flybacks for accurate testing of all types.**
- **Tests continuity of coils, speakers, switches, etc.**
- **Large 4½" meter, 3 colored scales.**
- **Complete with easy instructions.**
- **Compact, rugged, smartly styled.**

See it at your jobber today. Write for FREE Catalog RF-5 describing EICO's 38 Kits and 42 Wired Instruments. Prices 5% higher on West Coast.

EICO ELECTRONIC INSTRUMENT CO., Inc.
84 Withers Street, Brooklyn, N. Y.
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*for function and beauty*

TO THE EYE • TO THE EAR

**SHERWOOD HIGH FIDELITY S-1000 AMPLIFIER**

outstanding engineering provides: 20 watt ultra-linear output • push-button record equalization • Z729 low noise phono preamplifier • new "center-set" loudness control • rumble and scratch filters • speaker damping selector • tape recording provisions • 5 inputs



cabinets to fit any decorating scheme. $99.50 to $109.50 complete.

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ELECTRONIC LABORATORIES

Dept. 5R, 2802 W. CULLOM AVE. • CHICAGO 18, ILL.


window streamers, envelope stuffers, catalogue sheets, and advertising mats of all sizes. Theme of the sales literature ties in with the firm's national advertising theme, "So Simple to Operate".

Also offered is a plasticized counter display on hi-fi tape components and a new folder on the complete *Pentron* line. All of these items are described in a newly-released 4-page brochure entitled "Pentron Packs a Powerful Sales Punch," which is available from the company on request.

### KRYLON SALES "TOOLS"

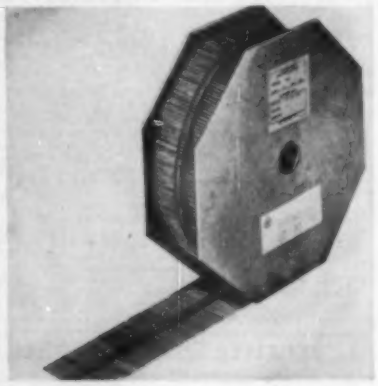
*Krylon, Inc.*, 2038 Washington Avenue, Philadelphia 46, Pa., has introduced a distinctive and novel promotion manual for use by its field organization from coast-to-coast.

The covers of the manual are unique and unusual. The covers, wrapped in clear vinyl plastic, display the actual full-color catalogue sheets issued by the company. The covers are bordered with two-tone tan and brown.

The manuals themselves include data on the company, its products, pricing, advertising, merchandising aids, publicity, testimonials, bulletins, and reserve sections for the salesman's additions.

### RESISTOR PACKAGING

A new method of packaging standard ½-watt, 1-watt, and 2-watt fixed resistors is now being offered by the



*Allen-Bradley Co.*, 136 W. Greenfield Ave., Milwaukee 4, Wis., for chassis automatic assembly lines. Octagonal 12-in. reels are available. Each reel contains 5000 resistors of the ½-watt size, 2000 of the 1-watt size, or 1000 of the 2-watt units.

The resistors are attached to the adhesive surface of a pressure sensitive tape which adheres only to the body of the resistor and not to the leads. A 12-in. leader precedes the first resistor.

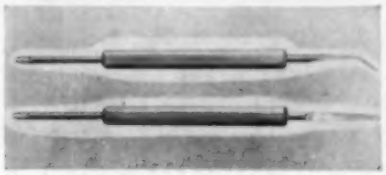
The reel, which is expendable, consists of a pair of octagonal corrugated board ends with metal bearings for use with 9/16-in. mandrels.

### SOLDERING AIDS

*CBS-Hytron* of Danvers, Mass., has come up with two more ingenious tools for the service technician. The latest additions in its line of "by-and-for-

servicemen" tool program are two hexagonal-handled models of its original soldering aid.

One of these redesigned "hex" units has the original straight reamer tip while the second offers an angled tip for reaching into a close-packed chas-



sis. The new flat-sided handle gives the tool a firm grip and checks elusive rolling when it is set down. The fork tip is as versatile as a pair of tiny metal fingers and obviates fumbling with long-nose pliers. The spade-type reamer tip clears the lug hole of solder or pushes unwanted wires aside.

Both of these tools are available from the company's distributors, who also handle the other items in the tool program line. —30—

## MARS STATION IN FRANCE

**NEAR La Rochelle, France is a busy MARS station which is providing a three-fold service to the military and civilian population. This station does three things, i.e., it keeps a channel open for military radio traffic in case of breakdown in land lines or in time of emergency; it allows standby operators and men working toward fulfilling their license requirements to practice sending in code; and it handles all types of morale messages for troops in the area.**

**In carrying out the third of these duties, MARS provides an excellent type of radio-telegraphic service for military personnel in Europe. Any number of "telegrams" may be set free of charge through their facilities to any place in the world. A soldier, dependent, or Department of the Army civilian has merely to contact the men affiliated with MARS to give them his message. They, in turn, send out all messages at a given time each day to the communications headquarters at Heidelberg, Germany, where they are relayed to Washington. From Washington the messages are sent to the military installation nearest the final destination where contact is established with a ham operator in the desired community and the information is dispatched to the address. The average time consumed in the delivery process from its initial transmission is 24 hours although there have been cases in which delivery has been made in 6 hours.**

**Officially the MARS equipment is government property and is maintained as such. However, men holding French amateur radio operators' permits are allowed to use the equipment for contacting other hams throughout the world when it is not being used for official business. Operators holding only American licenses are permitted to send only on MARS frequencies. The La Rochelle Amateur Radio Club, which numbers 18 American and 3 French members, works directly in conjunction with the MARS operation. This club, the only active one of its kind in France, provides facilities for licensed hams to keep their hand in and for newcomers to get the required practice for their licenses.** —30—




**TG-34A CODE KEYER**

Self-contained automatic unit, reproduces code practice signals recorded on paper tape. By use of built-in speaker, provides code-practice signals to one or more persons at speeds from 5 to 25 WPM. BRAND NEW, in original carton... **$16.88**

**FL8-A RADIO FILTER,** Used..... $1.59
New..... $2.45

**HEADPHONES**

| Model | Description | Excellent Used | BRAND NEW |
|---|---|---|---|
| HS-23 | High Impedance | $2.25 | $4.35 |
| HS-33 | Low Impedance | 1.79 | 4.65 |
| HS-30 | Low Imp. (featherwt.) | 1.49 | 1.85 |
| H-16-U | High Imp. (2 units) | 5.75 | 7.95 |
| CD-307A | cords, with PL55 plug and JK26 Jack | .... | .89 |

**NAVY RECEIVER TYPE ARB**

Four Band, 105 to 9050 kc. Low Freq., Ship, Broadcast—40 and 80 meters. Includes tubes and dynamotor, for 24 volt operation. Easily converted for 110 V., 12 V., or 6 V. Schematic Included. Excellent Condition. Overall: 8¼" x 7½" x 13½". Wt. 30 lbs. Special **$18.65**

**MICROPHONES**

| Model | Description | Excellent Used | BRAND NEW |
|---|---|---|---|
| T-17 | Carbon Hand Mike | $5.49 | $7.95 |
| T-30 | Carbon Throat Mike | .33 | .49 |
| T-45 | Navy Lip Mike | .... | 1.25 |
| RS-38 | Navy Type | 1.98 | 3.95 |
| T-24 | Carbon Mike | .... | 3.95 |

**FAMOUS BC-645 XMITTER-RECEIVER**



BRAND NEW

Makes wonderful mobile rig for 420-500 Mc. Easy to convert for phone or CW 2-way communication. CONVERSION DIAGRAM INCLUDED. This swell rig originally cost over $1000—yours for practically a song! You get it all, in original factory carton. BRAND NEW, complete with 17 tubes, less power supply. Shpg. wt. 25 lbs.... **$29.50**

**PE-101C DYNAMOTOR** for BC-645, has 12-24V input (easy to convert for 6V Battery operation) ..... only **$6.95**
**UHF ANTENNA ASSEMBLY,** for BC-645 ..... **$2.45**
**CONVERSION BOOKLET.** Instructions for most useful surplus rigs ..... **$2.50**

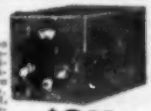
**SCR-274 COMMAND EQUIPMENT**

| Type | Description | USED | Excellent USED | BRAND NEW |
|---|---|---|---|---|
| BC-946 | 520 to 1500 Kc. Brdcast Revr., Incl. Tubes | .... | .... | $29.50 |
| BC-453 | Revr. 190-550 Kc. | $14.95 | $16.95 | 24.50 |
| BC-454 | Revr. 3-6 Mc. | 8.25 | 9.95 | 17.50 |
| BC-455 | Revr. 6-9 Mc. | 6.75 | 8.95 | 12.45 |
| BC-456 | Modulator | .... | 4.75 | 6.95 |
| BC-457 | Xmtr. 4-5.3 Mc. | 11.95 | 14.50 | 16.95 |
| BC-458 | Xmtr. 5.3-7 Mc. | 7.95 | 9.75 | 17.95 |
| BC-459 | Xmtr. 7-9.1 Mc. | 11.95 | 12.95 | 19.95 |
| BC-450 | 3-Revr. Control Box | .... | 4.75 | 7.95 |
| BC-451 | Xmtr. Control Box | .... | 1.25 | 1.49 |
| 3-Receiver Rack | | .... | 1.79 | 2.95 |
| 2-Transmitter Rack | | .... | 1.99 | 3.25 |
| Single Transmitter Rack | | .... | .... | 3.25 |

**DYNAMOTORS**

| Type | Input | Output | Excellent Used | BRAND NEW |
|---|---|---|---|---|
| DM-32A | 28V 1.1A | 250V .05A | 2.95 | 7.50 |
| DM-34D | 12V 2.8A | 220V .080A | 11.95 | .... |
| DM-36 | 28V 1.4A | 220V .080A | 8.95 | .... |
| DM-37 | 25.5V 9.2A | 625V .225A | 12.95 | .... |
| DM-28 | 28V | 234V .07A | 1.95 | 4.95 |
| DM-33A | 28V 1.4A | 220V .080A | 2.95 | 6.95 |
| DM-33A | 22V 5A<br>28V 7A | 575V .16A<br>540V .25A | 1.95 | 3.95 |

**BEACON RECEIVER BC-1206-C**



Complete with 5 tubes. Tunes 195 KC to 420 KC. 1 IF Frequency—135 KC. Receiver Sensitivity—3 Microvolts for 10 Milliwatts output. Output Impedance —500 Ohms and 400 Ohms. Volume Control—RF Gain Control. Power Supply—24-28 Volts Aeroplane Battery. Current—.75 Amperes. **$9.95**
BRAND NEW, with Tubes....
Used, with Tubes..... 6.95

**GOLD PLATED SPECIAL! TS-1/ARR-1 PORTABLE TEST**

OSCILLATOR. Complete with two 955 tubes and cavity. BRAND NEW in metal housing 9⅜"x5¼"x7" high. OUR LOW PRICE.....each **$3.99**

**GOULD 6-VOLT STORAGE BATTERY**

15 Amp. Hour Rating. Navy Standard. Black Rubber Case. BRAND NEW..... $5.95

**WILLARD 6-VOLT MIDGET STORAGE BATTERY**

3 Amp. Hour. BRAND NEW. 3⅜"x1-13/16"x2⅝". Uses Standard Electrolyte..... Only $1.85

**WILLARD 2-VOLT STORAGE BATTERY**

20 Amp. Hour. BRAND NEW. Transparent Plastic Case ..... $1.95

**1-QUART ELECTROLYTE,** enough for two cells, Bottle ..... $1.45

**A TERRIFIC BUY!**

**TS-100/AP 'SCOPE**



One of the most sensational values ever offered! Circular sweep, rate: 1.5 microseconds per inch, 12.2 microseconds per revolution. Linear sweep, rate: 12, 120 and 360 microseconds for 3" sweep. Self-contained in metal case 8"x 12½"x16½" deep. For 110V 50 to 1200 cycles AC. Demilitarized, NEW, with all tubes including crystals and C.R. Tube. OUR LOW PRICE ..... **$34.50**



**BC-696 XMITTER**

3 to 4 Megacycles. Only a few left at our amazingly low price. COMPLETE WITH CRYSTAL AND TUBES. Like New..... **$22.95**

**BC-375 and BC-191 XMITTERS**

200 to 500 KC., 1500 to 12500 KC., using plugin units shown below. 100 Watts. Voice and CW. Used. Your Choice, either type..... Each **$26.95**

**Tuning Units for BC-375 and BC-191**

| | | NEW | USED |
|---|---|---|---|
| TU-5 | 1.5 Mc to 3 Mc | $4.95 | $3.95 |
| TU-6 | 3 to 4.5 Mc | 4.95 | 3.25 |
| TU-7 | 4.5 to 6.2 Mc | 2.75 | 2.25 |
| TU-8 | 6.2 to 7.7 Mc | 2.95 | 2.25 |
| TU-9 | 7.7 to 10 Mc | 2.95 | 2.25 |
| TU-10 | 10 to 12.5 Mc | 2.95 | 2.25 |
| BC-306 | Antenna Tuner | 3.45 | 2.45 |

**SYNCHRONOUS SELSYNS**



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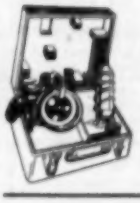
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## Hi-Fi Amplifier

(*Continued from page 63*)

flat setting using normal tolerance parts, (2) distortion difficulties because of high driver-tube voltage levels, and (3) intermediate treble curves have shelving actions.

Some of these difficulties can be overcome by using similar circuitry in a feedback configuration. Here, however, problems of instability are introduced with the shelving action still evident in one form or another.

A recent circuit with unity gain[3] eliminates the first two difficulties mentioned. The problem of shelving can be avoided by proper choice of a resistor inserted between the treble control tap and ground. The *Sherwood* design uses 47,000 ohms.

The response with the controls in the flat positions is ± ½ db or better. The controls' rotational positions for this response, in addition to being marked, are well defined due to a flat portion in the resistance element curve at the middle of the controls' range.

Following the tone controls is the loudness control. Its exact circuit position was determined as the best compromise between a too-high level position, which is free from hum pickup problems but subject to early stage overloading, and a too-low level position with the difficulties of hum and noise amplification.

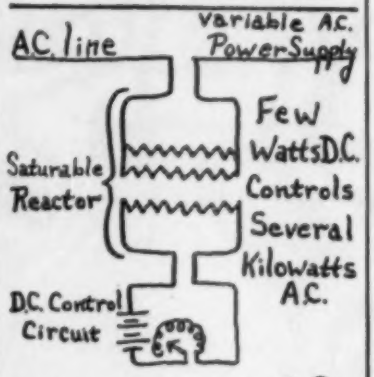
Although loudness controls with continuously variable compensation based on Fletcher-Munson curves[5,4] are quite familiar to the audio engineer, the less-informed high-fidelity user frequently condemns their operation, requesting that a loudness compensation "in-out" switch be provided to restore the action to that of a foolproof volume control. This user's difficulty arises from his usage habits with the conventional volume controls found on commercial radio and television sets. Here, the normal listening level is almost always obtained with the volume control near the "12 o'clock" or center position. A similar position on a typical loudness control results in as much as 15 db bass compensation, which is only desirable for low-level listening. Therefore, the user having his loudness control adjusted at 12 o'clock for normal listening, immediately complains of excessive bass compensation and loses faith in loudness controls. On the other hand, a flat or uncompensated level is usually available only near the full clockwise position. Controls thus adjusted, lack that extra reserve of gain which enables the user to show off his powerful amplifier's performance without disturbing preset level adjustments.

The loudness-control designer, desirous of overcoming these difficulties, is immediately confronted with a manufacturing problem. In order to have the loudness compensation introduced at a more counterclockwise position, he requires the control to be supplied


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with taps lower than the standard 37% and 62% rotation. At this time, no control has been made available in the highly mass-produced $1\frac{5}{16}$ in. diameter size with other than these standard taps. *Centralab*, however, now supplies its premium Model A ($1\frac{7}{16}$ in. dia.) control with special taps at 19% and 40% rotation. In addition, the advantages of its low-noise, long-life construction, made possible by a non-rubbing contact design, are "extra" benefits in the amplifier design.

The compensation curves obtained with this control are shown in Fig. 1. Note particularly the reserve +10 db range with no compensation above the 0 db reference level (normal loud listening). *All* compensation is completely removed (without change in level) for conventional volume control operation by means of a d.p.d.t. switch. To reduce the number of operating knobs, this switch was ganged with the power "off-on" switch.

One might ask whether the flat response settings of the control (see Fig. 1) do not violate the commonly accepted Fletcher-Munson loudness contours. On the contrary, they follow closely the equal-loudness contours for levels of 90 phons, and above, which are practically flat; thus offering a range of compensated loudness control operation complete from below 40 to 100 phons.

A 12AX7 27 db-gain stage follows the loudness control. Its cathode resistor is returned to ground through a ⅛ ohm resistor (2 inches of 0.75 ohm/ft. resistance wire) which is also in series with the output transformer's secondary ground return. Depending on the polarities of this connection (determined by the damping-factor selector switch), positive or negative *current* feedback from the speaker output is added to the voltage feedback around the power amplifier. With *no* current feedback (switch in center position), the amplifier has a damping factor of 7. This means a speaker connected to the 16-ohm terminal sees a 16/7-ohm source impedance. If the damping selector is switched to its "−2" damping position, current feedback is applied with the result that the speaker is driven by a minus 16/2 or minus 8-ohm source. This increased damping condition is frequently necessary with otherwise underdamped speaker systems to reduce transient bass hangover and distortion.

For already well-damped speakers, it might be preferable to use the "+7" or "+2" damping positions. Details of variable speaker damping have been covered in several articles.[5,6,7]

The output of the 12AX7 feeds through a double *RC* high-pass filter network ($R_m$, $R_m$, $C_m$, $C_m$). This network was designed to attenuate 27 cps (the most frequently-encountered phono turntable motor "rumble" frequency) by 12 db. The double *RC* frequency curve rises rapidly (see Fig. 2) so that bass notes of 100 cps are down only 1½ db. A typical bass tone control curve with this attenuation at







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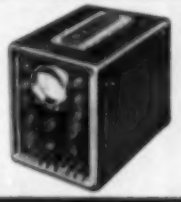
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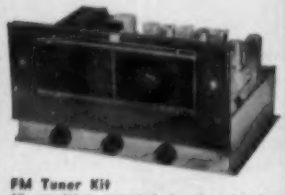
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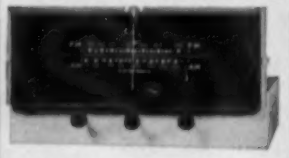
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100 cps would only be down 5 db at 27 cps. Conversely, a bass curve attenuating 27 cps by 12 db would still be down 8 db at 100 cps. From this, one can see the importance of having available such a special filter. Obviously, even the best bass tone control is not designed to handle this special turntable rumble situation.

On the other hand, the bass control's characteristics combine nicely with that of the rumble filter to give varying frequency turnovers to the sharp low-frequency filtering as shown in Fig. 2. Although the turntable rumble frequency is not always evident with less-effective loudspeaker systems, its presence still might drive a woofer into non-linear operating regions. The effectiveness of this filter, in this case, is in removing speaker IM distortion. A simple front-panel s.p.s.t. switch shorts out the filter for normal flat operation. Note the 10 megohm "click"-removing resistor, $R_m$.

In the power amplifier, virtues of the ultra-linear, push-pull output were utilized in obtaining 20 watts (at output tube grid current point) with either 6L6GA's or the newer 6L6GB's. The latter tubes allow more compact design and offer the advantages of the more modern button-stem construction.

The output pair is driven by a d.c.-coupled, split-load phase inverter, popularized by Williamson. Used in this stage is the new 12AU7A tube which features low-microphonic construction similar to that introduced in the premium 12AY7 tube.

The 14 db of inverse voltage feedback around this 3-tube system reduces the intermodulation distortion (60 cps:7 kc./4:1) to less than 1% at 10 watts while still maintaining a wide stability margin for use where the speaker load impedance happens to be capacitive.

The performance and flexibility found in a complete unit of this type was unheard of just a few years ago. Combining uncomplicated circuitry and simplicity of controls with complete versatility and excellent response—all in one compact unit—represents another step forward for the high fidelity enthusiast.

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—30—

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**Regular power pentodes like the 6AQ5 require a lot of plate power, and their power sensitivity is not particularly high because they were designed primarily for high output. The most sensitive power pentode, the 6BK5, gets its high gain by using a large cathode, and the heater alone draws 7.5 watts. To get high sensitivity at low power input, what is needed is a tube having high transconductance per ma. of plate current, and a reasonable-sized heater. Voltage amplifier pentodes, such as the 6AU6, fill these requirements.**

**It turns out that a 6AU6 makes a junior-sized output tube that is more sensitive than any except the 6BK5, and at a fraction of the power drain on the supply. It has, moreover, a much higher power sensitivity per watt of drain from the supply than any of the audio power pentodes.**

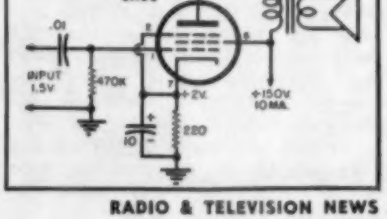
**Fig. 1 shows a typical circuit. The load impedance should be about 20,000 ohms. Changing it to 15,000 or 25,000 ohms will not make much difference. A good output transformer is one rated for battery-type power tubes, such as the Stancor A3327 or Knight 62G94.**

**If the plate supply voltage is higher than 150, use a dropping resistor in series with the screen of the 6AU6 and bypass the screen to the cathode with a 10 μfd., 150-volt electrolytic, otherwise the screen will overheat. For a 300-volt supply, the correct resistance is 56,000 ohms and for a 250-volt supply, 33,000 ohms. For all supply voltages the 220-ohm cathode resistor is best, and the plate and screen currents are 7 and 3 ma. respectively.**

**At 1.5 volts audio input, the 6AU6 so used will put out 360 milliwatts of audio. In comparison, a 6AS5 at the same 1.5 volt signal supplies only 140 milliwatts and a 6AK6 only 65 milliwatts. With a 300-volt supply and the necessary screen dropping resistor, 6AU6 output is about 500 milliwatts at overload.**

**While many other small pentode types such as the 6CB6 and 6AH6 have even higher transconductance per ma., they are not satisfactory for class A power service because their screen current rises too high during large signals. In general the operating conditions for maximum power output in class A are low grid bias together with the highest screen voltage permissible within the rating of the tube.** —30—

**Fig. 1. The high-efficiency, sensitive audio output stage for intercoms and mobile gear. Output is .36 watt with 1.5 volts input and only 10 milliampere power drain.**



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Trouble-shooting and servicing are included. You will be taught to recognize and repair troubles. You will build and learn to operate a professional Signal Tracer. You receive an Electrical and Radio Tester, and learn to use it for radio repairs. While you are learning in this practical way, you will be able to do many a repair job for your neighbors and friends, and charge fees which will far exceed the small cost of the "Edu-Kit." Here is your opportunity to learn radio quickly and easily, and have others pay for it.

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**• ELECTRICAL & RADIO TESTER • ELECTRIC SOLDERING IRON • TV BOOK • QUIZZES • HIGH FIDELITY GUIDE**

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MAIL TODAY—Order shipped same day received.
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**PROGRESSIVE "EDU-KITS" INC.**

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On shipment to a New York City address, add 60¢ sales tax.

BUILD 15 RADIOS AT HOME WITH THE PROGRESSIVE RADIO "EDU-KIT". MAIL TODAY.

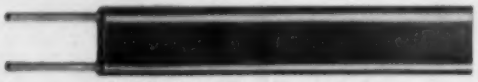
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# RADIO-TV Service Industry News

**AS REPORTED BY THE TELEVISION TECHNICIANS LECTURE BUREAU**

THIS month, we would like to present information about the programs drawn up by various representative TV and radio service associations. An excellent idea of the problems facing the service technician and dealer can be obtained from these programs since their purpose is to aid the association membership to overcome their problems.

## NATESA

The goal of NATESA in the coming months will be the improvement of consumer relations as fast as possible. Too many set owners have vague ideas of what is honest service. They have not been told that the set they purchased will require regular maintenance, or that parts not only break down, but wear out with use, just as the tires on their car. Too few set owners know what constitutes a legitimate service call or shop job fee, so they fall prey to phony advertisers. Therefore, they condemn all service people.

Since these problems hinge upon education of set owners, NATESA's aim will be to expedite its consumer relations activity. Already, occupational standards have been created and these will be expanded based, largely, on industry standards. NATESA will set up a system for guaranteeing its members' work. Advertising and other media will be used.

Another serious loss of revenue independent service is suffering is through wholesale sales to retail customers. Trial runs are now in process on an idea which may prove conclusively the fallacy of such sales activity.

To achieve their plans, a drive is in progress to bring into NATESA every local and regional association not yet affiliated. NATESA invites all service people to attend and take part in the next Radio-TV Service Industry Convention and Show in Chicago from August 19 through the 21st.

## ARTS

In considering a program of action for the Associated Radio & TV Servicemen of Chicago, its Executive Committee has taken into consideration several things. The ARTS is a young association and has, so to speak, weathered its infancy and come of age. They feel that they have found so many things crying to be remedied that it is hard to determine which should come first. Consequently, the plans which the group contemplate stretch beyond the limits of the next several months, to be outlined and put to work on a more or less long-range basis.

One of the first things that has been undertaken is a program of lectures on color. The splendid cooperation of the manufacturers of color TV sets and equipment made these lectures possible. The lectures made quite an impression on those technicians who attended and caused them to inquire about the group's aims and policies. This has indicated to the officers that these lectures are a needed service. Given the chance, they will draw technicians together.

The next series of lectures, to be presented next Fall and Winter, will be on subjects related more to business operation than to technical material.

The next major undertaking which is now being put into action is the organization's fight against "jobber back door selling." The Association last year adopted a resolution defining its stand with respect to this evil. The ARTS policy is to let technicians know that there is a strong group which is fighting this practice.

Another matter brought to the attention of the ARTS is the apparent lack of respect with which the average technician regards himself and his work. The ARTS officers plan a campaign that can best be described as "Serviceman, don't sell yourself short." The goal is to get service businessmen to respect their knowledge and work and place a value on themselves, so that they will begin to demand and get the respect from the general public.

## TSA

TSA of Michigan has grown from a small group of fifteen to over one hundred select members and associates in four years' time.

In May of 1952, the TSA was confronted by a multitude of problems—mainly those of malpractices, fly-by-night tactics, and general incompetence. At that time a joint committee with various civic groups and law enforcement agencies was formed to unify the efforts for curing the evils in the TV servicing field. This affiliation and unification of thinking made an ideal union. The association engaged in a series of policing activities which resulted in a thorough analysis of the advertising methods and operational characteristics of television service companies detrimental to the television profession.

A bait advertising ordinance was an outgrowth of the investigation, and it was made a city ordinance in 1954. The TSA and the governing body of Detroit felt that this ordinance was a stop-gap since theoretically, its application could remove the "foot in the door." However, it became apparent that in order to make this law effective, every form of advertising had to be scrutinized, its gimmick determined, and then proceedings begun for conviction.

The TSA, in addition to this activity, promulgated many educational programs in conjunction with manufacturers and industrial groups. The relationship between all civic groups and the Association has resulted in many progressive programs—such as the promotion of the u.h.f. channel for the Detroit Board of Education.

Although the TSA in the past has fought all forms of licensing legislation, they now believe that existing laws cannot curtail unethical practices which are on the increase. The TSA in a unanimous vote decided in favor of a licensing ordinance. This ordinance was drawn up by a TSA committee and presented to the legislative body of Detroit for evaluation.

## TRA

As the result of several months of planning and meetings, the Television Radio Association of Alameda County, Incorporated, of California, has developed a working organization. From all indications, the problems of the television servicing businesses in California seem to be the same as those in New York City or Timbuktu.

Probably the most serious questions


SAVE!...BARGAINS GALORE!...SAVE!

COMMAND SETS
NEVER BEFORE! . . . NEVER AGAIN!
"Q"5'rs 190-550 KC $10.95
LIKE NEW! XLNT COND.
274N and ARC 5 EQUIPMENT



Type
BC-455 40 Meter Recr. 6-9 Mc. Used. with tubes. $3.95
Used—Like New . . . . . $4.95
Brand New . . . . $5.95
BC-454 Recvr. 3-6 Mc. Used with tubes. XLNT . . . . . $7.95
Dynamotor for above Recvr. $1.00 ea. with each Recvr.
1.6 to 3 Mc. Arc 5. Ship Band Recvr. Like New . . . . . $9.95
BC-458 Modulator, Used with tubes . . . . . 3.95
Sold as is. Less tubes . . . . . 2.95
BC-696 Xmtr. 3-4 Mc. As is. Less tubes . . 9.95
BC-457 Xmtr. 4-5.3 Mc. Used, with tubes 9.95
Sold as is. Less tubes . . . . . 3.95
BC-488 Xmtr. 5.3-7 Mc. Used, with tubes 4.95
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BC-459 Xmtr. 7-9.1 Mc. Used, with tubes 9.95
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BC-450 2 Recr Control Box. Used . . . . . 1.49
BC-451 Xmtr. Control Box. Used . . . . . 1.49
3 Receiver Rack. Used . . . . . 1.49
2 Xmtr. Rack. Used . . . . . 1.49
Fil. XFMER for above equipment—110 Pri. Sec., 24 V—CT @ 2 Amps. New . . . . . 2.49

Command Sets—Combination Specials
40 Meter Group
1-BC-458 Xmtr.—5.3-7 Mc. Xtal. Cond. with Tubes.
1-BC-458 Modulator, Xtal. Cond. with Tubes.
1-BC-455—6-9 Mc. Recvr., Xtal Cond. with Tubes.
Special—Complete Group . . . . . $12.95
75 & 80 Meter Group
1-BC-457 Xmtr., 4-5.3 Mc. Xtal Cond. with Tubes.
1-BC-458 Modulator, Xtal. Cond. with Tubes.
1-BC-454—3-6 Mc. Recvr., Xtal. Cond with Tubes.
Special—Complete Group . . . . . $14.95
Combination of Above 2 Groups less 1 Modulator—Special . . . . . $25.95



110 V. Power Supply Arc 5 or 274N Command Receivers
Just plug it into the rear of your 274-N RECEIVER . . . any model. Complete bit and black metal case, with ALL parts and diagrams. Simple and easy to build in a jiffy. Delivers 24 volts plus B voltage. No wiring changes to be made. Designed especially for the 274-N receiver. Only $6.95.
Assem. . . . . $12.95

METERS—WESTON • SANGAMO
All New. All D.C. 2" Square.
0-2 Ma
0-5 Ma
0-15 Ma
0-50 Ma
0-100 Ma
0-200 Ma
0-300 Ma
0-500 Ma
$3.29 each or 3 for $9.00



DC VOLT METERS—2" SQ.
0-20 V. DC
0-40 V. DC
0-300 V. DC
$3.29 each or 3 for $9.00
BC-375 Med. XFMR. Matches pair of 6146's, 815, 807, 1625. New . . . $2.95

OIL CONDENSERS



2 MFD—5000VDC GE. New . . . . . $2.95
1 MFD—Sprague, 4000 V. New . . . . . 1.95
2 MFD—GE, 4000 V. New . . . . . 3.95
2 MFD—Aerovox, 2500 V. New . . . . . 2.49
10 MFD—Fast, 600 V. New . . . . . 1.49
2 MFD—Aerovox or Solar, 600 V. New . . . . . 3 for .89
4 MFD—GE, 600 V. DC. New . . . . . .97

PLATE TRANSFORMER
American Trans. Co. Input: 115 V.A.C. 60 Cycle. Sec. 2240 V.A.C. CT @ 500 Ma.
BRAND NEW . . . . . $14.95
Shipping Wt. 55 lbs.



BC-357
Radio Beacon Receiver
62-80 Mc. radio controlled receiver. Contains 10,000 ohm plate relay. Power requirements are 24 V. AC. @ 5 Amps. and 220 V. DC. @ 20 Ma. Swell for Garage Door Opener, Receiver, and other remote control installations.
Brand New . . . . . $4.95

TRANSMITTERS
GP-7 TRANSMITTER
100-watt master oscillator type. Can be used on any frequency from 350 to 9050 KC by using the proper plug-in tuning unit. Type 809 PA and built-in 400 cycle power supply using a pair of 1616 rectifiers. Three 2-inch panel meters: 0-300 MA DC, 0-8 RF Amps, 0-15 AC Volts. A gold mine of excellent usable components for building and servicing any high wattage rig. Comes complete with one tuning unit and tubes. Excellent condition . . . . . $13.95



ARR-2 RECEIVER
220-258 MC. TUNABLE
11 Tube Superhet. Easily converts to 2 meters.
Like New . . . . . $7.95
Control Box . . . $1.50

Broadcast Band and Aero MN-26C Installation



A 12 tube remote control manual direction finder desirable for commercial type navigation on boats and planes. Has a frequency range of 150 kc to 1500 kc in 3 bands. This frequency covers the beacon and standard broadcast bands. Operates on 28 V. DC input. Complete installation consists of:
MN-26C Receiver Brand New $34.95
MN-26B Rotable Loop New 4.95
MN-52 Azimuth Control Box . . . . . New 2.95

ARB NAVY RECEIVER
105 to 9050 KC. Four Bands, Calibrated Dial, LF-Ship-BC—80 & 40 Meter—Complete with Tubes and Dynamotor. For 24 Volt operation; easily converted to 110 V—12 or 6 Volt. Size 8¼" x 7¼" x 15½". Like New. With schematic. Weight 30 lbs. . . . . $14.95

PHONE-CW FILTER
MODEL FL-8
Completely eliminate 1020 cycle CW signals when used on Phone bands—or—flip a switch and only 1020 cycle CW Signals come thru! New . . . . ea. $1.89



6 & 12 Volt Dynamotor Specials



PE-101C DYNAMOTOR
This is the Dynamotor the hams have been talking about! Easily adapted to supply on 12 V. input 500 V. DC. @ 200 Ma. and also 325 V. DC. @ 125 Ma. Brand New . . . . $6.95
Eicor Dynamotor—11.6 V. DC. input. Output 425 V. DC. @ 375 Ma. Brand New . . . . . $10.95
Wincharger Dynamotor—12 V. input. Output 440 V. DC. @ 220 Ma. Brand New . . . . . $14.95
BD-77 Dynamotor—12 V. input. Output 1000 V. DC. @ 350 Ma. Brand New . . . . . $14.95
BD-69 Dynamotor—Made by Eicor—14 V. input @ 2.8 A. Output 220 V. DC. @ 80 Ma. Brand New . . . . $9.95
PE-73 Dynamotor—24 V. input. Output 1000 V. DC. @ 350 Ma. Brand New . . . . . $9.95
Used . . . . . $6.95

All prices subject to change without notice
Cash with order. Include 4% Sales Tax with California orders—All orders F.O.B. Los Angeles.
SAM'S SURPLUS, 1306 BOND ST., LOS ANGELES 15, CAL.

**New PORTABLE DOUBLE-DUTY Money-Maker**

**TESTS and REPAIRS TV PICTURE TUBES**



Size only 11" x 7½" x 5"

**Amazing Low Price $54.95 NET**

No extra accessories necessary

**CATHODE REJUVENATOR TESTER**

**Spots the Trouble and Quickly Corrects it—without removing tube from set!**

Now it's easy to save thousands of weak and inoperative TV picture tubes. As much as 80% of the troubles which arise in picture tubes may easily be repaired with the CRT. This amazing portable instrument creates new profitable picture tube repair business. Saves servicing time, speeds work. Assures more satisfied customers. Eliminates tube transportation. Saves money on trade-in reconditioning. And at such low cost, the CRT quickly pays for itself—and continues to make big profits for TV service-dealers.

*See Your Distributor, or Write for Bulletin No. 102-N*

***DOES ALL THIS***

**TESTS FOR** Emission, Inter-Element Shorts, Leakage, Open Circuits, Grid Cut-Off, Gas Content, Probable Useful Life

**RESTORES** Emission and Brightness

**REMOVES** Shorts

**REPAIRS** Open Circuits

Less than one foot long. Weighs only five pounds.

**B&K MFG. CO.** 3731 N. Southport · Chicago 13, Illinois

**USED RECORDING TAPE (PLASTIC BASE)**

ATTENTION: Radio Stations, electronic calculators, industrial users: We have the new 1½ or 2 mil mylar, "unsqueeze," "lifetime," or "H.O." tapes and we will buy or exchange your present 1 mil mylar or plastic tapes.

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| 1.79 for 7"— | 1200 foot |
| .99 for 5"— | 600 foot |
| .59 for 4"— | 300 foot |
| .29 for 3"— | 150 foot |

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**USED "MYLAR" TAPE (1 Mil)**

1800 ft. (7" reel) . . . . 2.99



Now empty plastic reels in boxes for easy labeling. 3" 10c; 4" 22c 5" 24c; 7" Professional reel (2¼" hub) 29c ea. EMPTY BOXES: 3" 3c; 4", 5", 7" 5c ea.

We carry all brands of new tape, recording blanks, tape recorders, etc., at low prices. PLEASE INCLUDE SUFFICIENT POSTAGE.

SEND FOR NEW PRICE SHEET

**COMMISSIONED ELECTRONICS CO.**

2303 Champlain St. N.W. Washington 9, D. C.

**NEW ELECTRONIC GARAGE DOOR OPERATOR**



Now you can install your own electronic garage door operator—and save over half the cost. The Bellford-Matic is precision engineered with a ¼ h.p. Westinghouse motor, Cutler-Hammer relays and other top quality components and is sold on a money-back guarantee. Post Controlled Unit—Complete assembly kit $69.00. Post Controlled Unit—Factory assembled, ready to install $89.00. Radio Controlled Unit—Factory assembled includes transmitter, receiver, operator and controls, ready to install $139.00. All prices F.O.B. Factory. Write for complete folder. Dealer inquiries invited.

$69.00

**BELLFORD-MATIC, INC.**

Dept. R, Maurice Ave., Cleveland 27, Ohio


demanding settlement are those of bait advertising, and the tube puller and backyard mechanic. To combat this competition the Association is making available to its members inexpensive, cooperative advertising material for direct mail. Membership identification cards are available, to be followed by newspaper advertising requesting customers to ask for the cards. Group insurance will be offered soon, to cover shop owners, their families, and all employees. Financing arrangements are being worked out to finance shop repair jobs—the plan being considered permits the shop to arrange all details without the customer going to a finance company office to sign papers and give credit information.

As for Association activity itself, the program for 1955 is quite ambitious. Currently, in cooperation with the Better Business Bureau, a new Code of Ethics is being written and will be presented to the industry as a whole during the next few weeks. The new code is aimed primarily at bait advertisers and junk displays seen in the daily papers. A $5.00 service charge was deemed fair by the Better Business Bureau and anything under that amount would be considered bait advertising.

The Association is also busily compiling as much data as possible on licensing, including what has been done in other parts of the country. From this information, a licensing bill will be drawn and held ready for presentation to the State Legislature if conditions warrant such action. However, it is felt that licensing, with all the ramifications and policing problems in a large state such as California, should be the last resort.

## LIETA

Last Fall, the Long Island Electronic Technicians Association presented its members to the public in a booth at the Mineola Fair, and a month later in a booth at a local home-furnishings show. It was so successful that LIETA plans to participate in more and more of them.

The LIETA also aims to enlarge their community service program of providing television and radio service free to hospitals and some shut-ins. This program has gained for them an excellent press relationship with the leading papers on Long Island. They are also enlarging their lecture program in Nassau County and are striving to set up a standard price structure.

This association also tests bench equipment, instruments, and tools and grants a "LIETA Seal of Approval" to equipment they think is superior. The LIETA employment exchange helps its members find the right man for their job openings.

In our attempts to bring our service readers up-to-date on the events in their field, this column has reported on the activities of five service associations. More news on association

activities and plans for the future will be presented in forthcoming issues of this magazine.

We wish to thank Frank Moch, President, National Alliance of Television and Electronic Service Associations; Howard Wolfson, Chairman, Associated Radio and Television Servicemen of Chicago; Harold Chase, Television Service Association of Michigan; Ernest S. Copley, Television-Radio Association of Alameda County; and Harold F. McFarland, Long Island Electronics Technicians Association for their valuable contributions to this column. —30—

## OVER 7.1 MILLION TV SETS SHIPPED TO DEALERS IN 1954

**THE Radio-Electronics-Television Manufacturers Association reported that over 7.1 million television receivers were shipped to dealers during 1954, an increase of nearly half a million from 1953. The actual figure was 7,161,362 as against 6,704,193 TV sets shipped in 1953. The table below shows TV set shipments to dealers by states for the year 1954.**

| STATE | TOTAL | STATE | TOTAL |
|---|---|---|---|
| Alabama | 106,829 | New Jersey | 202,155 |
| Arizona | 54,585 | New Mexico | 24,497 |
| Arkansas | 92,192 | New York | 653,852 |
| California | 517,935 | North Carolina | 176,317 |
| Colorado | 59,352 | North Dakota | 34,658 |
| Connecticut | 95,560 | Ohio | 356,009 |
| Delaware | 15,960 | Oklahoma | 102,161 |
| D. C. | 47,895 | Oregon | 84,913 |
| Florida | 218,286 | Pennsylvania | 465,785 |
| Georgia | 160,606 | Rhode Island | 34,356 |
| Idaho | 41,679 | South Carolina | 99,891 |
| Illinois | 439,127 | South Dakota | 24,409 |
| Indiana | 216,854 | Tennessee | 152,683 |
| Iowa | 157,285 | Texas | 379,646 |
| Kansas | 119,186 | Utah | 27,850 |
| Kentucky | 94,038 | Vermont | 26,324 |
| Louisiana | 146,148 | Virginia | 122,330 |
| Maine | 92,854 | Washington | 126,418 |
| Maryland | 85,703 | West Virginia | 80,755 |
| Massachusetts | 190,475 | Wisconsin | 191,612 |
| Michigan | 295,771 | Wyoming | 8,088 |
| Minnesota | 145,082 | | |
| Mississippi | 58,239 | U. S. TOTAL | 7,147,953 |
| Missouri | 204,568 | Alaska | 3,166 |
| Montana | 26,588 | Hawaii | 10,243 |
| Nebraska | 75,443 | | |
| Nevada | 8,536 | GRAND TOTAL | 7,161,362 |
| New Hampshire | 34,876 | | |

## CATHODE-RAY TUBE SALES SET NEW MARK

**A NEW record for the sale of cathode-ray tubes was set during 1954 when 9,913,504 units worth $209,182,344 were sold by manufacturers, according to a RETMA report. This compares with 9,839,138 tubes valued at $234,861,041 sold in 1953. Receiving tube sales in 1954 were down from 1953 with the 1954 figures 385,089,458 for a worth of $275,998,903 as compared with 437,091,555 tubes valued at $303,675,313 sold in 1953.**

## TV RETAIL SALES ESTABLISH A RECORD

**RETAIL sales of television receivers in 1954 increased by nearly 1 million units from the level of 1953 to establish a new high, according to the RETMA. Some 7,317,034 TV receivers were sold at retail compared with 6,370,571 sets in 1953. Retail sales of radios, excluding automobile receivers, totaled 6,430,743 units as compared with 7,031,293 sets sold in 1953. An additional 4.1 million automobile radios were manufactured during the year. Most of these receivers are sold direct to auto manufacturers for installation in new cars.** —30—


# SENSATIONAL SAVINGS AT AIREX

## Airex's New Auto-Focus 30-Tube 1955 Channeloc 630FA4

**ACCLAIMED BY THOUSANDS AS THE WORLD'S FINEST TV RECEIVER**

**• Up to 200 Miles Reception • Hi Gain Cascode Tuner • 4 Microvolt Sensitivity**

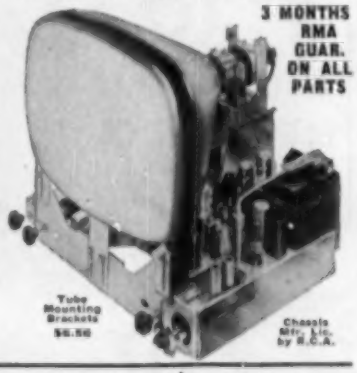
***The Perfect Chassis for Fringe Areas***

***New Exclusive Advancements***

• Pictures always in focus • Hi & Low sync. Amplifier • Channeloc—Locks picture & sound together • Drift free operation • Automatic Freq. control • Gated A.G.C. • Full 4 MC Picture Bandwidth • Phono connection & Switch • Efficient Retrace Blanking • Automatic Brightness Control • Full Focus Cosine Yoke • Fused HV Power Supply • Molded Plastic condensers • 6CB6 Tubes in Video I.F. • Handles up to 24" Rad • Improved Sync System • Autoformer Fly Back • Improved Video amplification • Heavy Duty Power Transformer • Improved Horizontal sweep • Full range 12" Loudspeaker • 4 Microvolt Sensitivity • Ready for UHF Stations • Size 22" x 22" x 24" with 21" tube mounted.

**$149.95**

With 12" Hi-Fi R.C.A. Speaker. Less CR Tube & Brackets



3 MONTHS RMA GUAR. ON ALL PARTS

Tube Mounting Brackets $6.50

Chassis Mfg. Lic. by R.C.A.

**Detailed Service Manual & Schematic $1.00**

### Sensational Cabinet Bargain



**FOR 630 CHASSIS**

Beautiful lustrous hand rubbed, mahogany finished cabinet for 21" tube size. Price includes mask, glass & wood mounting brackets. Brochure available.

Mahogany finish ..... **$49.95**

Blond Mah. finish ..... **$59.95**

For 24" & 27" tubes

Mahogany finish **$74.95**

Blond Mah. finish ..... **$84.95**

**Combination Saving**

FA-4 Chassis 21" Tube Mah. Cons. Cabinet. **$224.95**

**Plastic Masks**

20" and 21" ..... $ 7.00
24" ..... $14.00
27" ..... $17.00

### 630-9 TV Chassis for 24" & 27" Tube

• Channeloc—Picture & sound locked together • No drift • Reception up to 200 miles • 90 degree deflection • 22 KV high voltage power supply • For 24" & 27" rect. tubes • Phono connection & switch on chassis • Aseptable for color • RMA guarantee.

**$179.95** With 12" Hi-Fi RCA Speaker

Tube Mtg. Brackets $9.95

### TV PICTURE TUBES

Nationally Known Brands. Aluminized TV Tubes. New. Full 1 Year Guarantee.

• 21" Tube ..... $24.95
• 24" Tube Rect. ..... $49.95
• 27" Tube Rect. ..... $74.95



### New OGYRO Invisible TV Antenna

This twin dipole antenna is invisible when installed. Full dipole efficiency assures excellent results. Eliminates unsightly rabbit ears and roof antennas in most locations. Uses patented Ceroc wire for invisibility. **$1.00**

***Send For Hi-Fidelity Parts Catalog***

### SENSATIONAL TV TUNER SALE



Here is your chance to get in on a special purchase of NEW TURRET TV TUNERS. Because of this low, low price, we can't give the mfr's name. Complete with 6J6 and 6AG5 tubes. Built-in wave trap, removable channel strips, positive click stop. Shaft length 2½". For 21 MC IF circuit. An ideal replacement for all sets . . . $7.95 each.....Lots of 3 **$6.95**

### CUSTOM MADE 10 WATT HI-FI AMPLIFIER



Here is the perfect amplifier for a budget installation. Push-pull 6V6 output tubes, 6SC7 pre-amp for reluctance cartridges, 6SL7 phase inverter and 6x5 rect. Power output 10 Watts. Less than 1% distortion. Frequency range 20-20,000 cps ± 1 db. Separate bass and treble control. 4, 8, 16 ohm output taps. Size 9x7x5". **$24.95**

### Nationally Known Recording Tape

7" reel, 1200 ft., red oxide base. Lots of 12 . $1.59
In lots of 3 ..... 1.75
LP 7" reel (1800 ft.) Mylar Tape .001—$4.79

### EASY-TO-BUILD TV KIT



Here is your opportunity to make a television set at an unbelievable low price. New Vertical chassis design saves 50% space requirements of conventional sets. Complete with 14 tubes, all parts, step-by-step instruction manual, large wall mounting diagrams. Free factory service department at your disposal. Send today for your TV kit. Knowledge of television is not necessary. Cabinets available. Illustrated folder. **$79.95** LESS CRT.

We have in stock the largest selection of Hi-Fi equipment & speaker enclosures at low, low prices. Send us your requirements. Immediate reply.

### Lowest Prices on Record Changers

**LATEST MODEL INTERMIX WEBSTER**



**Now $25.88**

Model 140 Webster with the new turnover Sonette hi-fi cartridge & 3 sapphire styli. Automatic shut-off feature.

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## CATHODE FOLLOWER

By RICHARD C. SAUNDERS

MOST r.f. signal generators are provided with a 400-cycle audio oscillator to modulate the r.f. signal, with a separate output also provided for audio output.

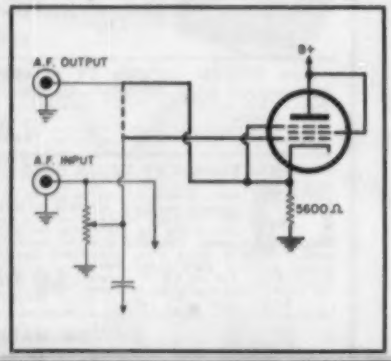
However, this audio signal is often too weak for many applications such as distortion, impedance, and inductance measurements. A simple method of improving the signal output is to provide a cathode follower stage in the output circuit.

The accompanying diagram shows a simple circuit which requires a minimum of parts, yet is quite efficient in operation. There are a number of tubes which may be used for this purpose, such as a 6C4, a triode-connected 6AU6, etc. If space is not at a premium, some of the larger GT tubes may also be used.

In the circuit shown, using a triode-connected 6AU6, an output of approximately 3 volts may be obtained, whereas previous to the addition of the stage, the output of the audio oscillator alone would barely deflect a voltmeter.

The power requirements for the additional stage are small, and may be obtained directly from the signal generator power supply in most cases. —30—

The cathode-follower output stage (shown in heavy lines) has been added to a Heathkit SG-8 r.f. signal generator. The dotted line indicates the only circuit change in the generator. The only parts required are tube, socket, and 5600 ohm resistor.





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# WHAT'S NEW IN RADIO

**The products described in this column are for your convenience in keeping up-to-date on the new equipment being offered by manufacturers. For more complete information on any of these products, write direct to the company involved.**

### TUBE TESTER KIT

*Allied Radio Corporation*, 100 N. Western Ave., Chicago 80, Illinois, is now marketing itz new, low-cost "Knight" tube tester kit, an easy-to-build and versatile unit.

In addition to measuring tube performance by the cathode-emission method, the tube tester checks for shorted elements, opens, and heater



continuity. It can be used for testing 4-, 5-, 6-, and 7-pin large, regular, and miniature types as well as octals, loctals, 9-pin miniatures, and pilot lamps.

A 4½" meter, plus a line voltage compensator and a clearly marked, smooth-operating roll chart, assure quick, highly accurate testing. The kit is available in two types—one for counter use and the other in a portable carrying case. An adapter to permit checking TV picture tubes is available at a slight additional charge.

### MOBILE RADIO LINE

*General Electric Company*, Syracuse, New York, is now offering its new "Progress Line" of FM mobile and base station two-way radio communications equipment for both 25-54 mc. and 144-174 mc. land-mobile radio services.

Featuring the use of plug-in chassis, the new line has been designed around



twelve basic "building blocks" of standardized physical dimensions. Flexibility has been provided by designing each of the chassis (transmitters, receivers, and power supplies) so that it





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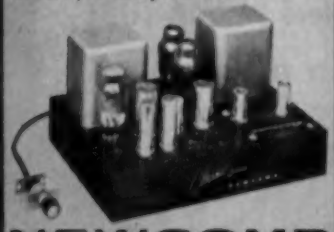

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is completely interchangeable with other units of its type mounted in either a base station or mobile housing.

The twelve basic building blocks consist of two receiver, four transmitter, and six power supply chassis. Sixty different mobile two-way radios are available as standard units by combining the appropriate "blocks."

### LINK MOBILE UNIT

*Link Radio Corp.*, 125 W. 17th Street, New York 11, N. Y., has added the Model 2365-M-Ed.8 mobile combination transmitter-receiver to its line of two-way radio communications equipment.

The unit which operates in the 25-50 mc. band (25-30 watt output) is designed to work from either a 6 or 12 volt battery without wiring, component, or cable changes. The changeover is accomplished by merely shifting a plug located on the top of the chassis.



This new equipment, which is designed for police, fire, taxi, commercial fleet, and utility applications, is supplied as a complete package with necessary accessories.

### PRINTED CIRCUIT KIT

*Circuit Engineering Co.*, 1871 Grove Street, Glenview, Illinois, has developed a printed circuit kit which enables the experimenter or beginner to apply the same methods used by manufacturers to his own circuits and construction.

This inexpensive kit comes complete with copper clad laminate, etching tray, resist ink, ferric chloride solution, pen holder, pen point, and complete instructions for making a number of complete printed circuit chassis.

### BRACH "MAGNE-TENNA"

*Brach Manufacturing Company*, 200 Central Avenue, Newark, N. J., has introduced a new antenna which will absorb TV signals like a magnetic funnel, making it an efficient design.



The "Magne-Tenna" incorporates a formulation of magnetic material as well as new circuit techniques which


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McELROY CODE KEYER
Model 443. Consists of Wheatstone perforator with 3-key board. Electronic 110 AC power supply WITH SPEED CONTROL! One reel and tape ADDED FREE! New Boxed. SPECIAL ..... $19.95

APS-13 TAIL END CHARLIE
BRAND NEW. Complete with ALL TUBES and DYNAMOTOR. Limited quantity. EACH ..... $12.95
Two (2) for ONLY ..... $25.00!

COMMAND STEALS!
"Q" 5'ER—This is the real McCoy! Good condition. Complete with all tubes. A regular $19.95 value. JUST REDUCED TO $7.95
AIRCRAFT 75 & 80 METER RECEIVER: Good condition. Complete with tubes. ONLY ..... $5.95
4-5.3 MC TRANSMITTER: This baby is in beautiful condition. Easily convertible to 75 and 80 meters band. WITH ALL TUBES, ONLY ..... $7.95

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Pri. imp. 1½ ohms. Sec. 10 ohms. Brand new—packaged. Used in BC-745 Horsie-Talkie. Ea. ..... 49c

HS-18 HEADSET: High impedance, 8,000 ohm, with R-14 Units. New, Orig. package. Per PAIR.... $1.99 2 PAIR for.... $2.75

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Removed from TV sets. Continuous tuning type. Fair condition. Each ONLY.. 49c
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DYNAMOTOR GIVEAWAYS! We mean cheap!
PE-55—The ones you wanted! Terrific for your transmitters! 12 V. input. 500 V. output @ 350 mils. Excellent cond. ..... $17.50

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For yer mobile rig! 12 V. input. 172 VDC output @ 138 MA. Small, compact. BRAND NEW, with spare parts kit. Ea. ..... $1.95
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Input 6-12 VDC. Output 500 VDC @ 200 MA. Brand new. Orig. box ..... $29.95

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6 V. CONTROL RELAY: Many contacts. NEW BOXED. Each 69¢! 3 for ..... $1.79

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We're putting this in to see if you guys are really paying attention. We will actually give you 50 LBS. OR MORE of Signal Corps electronic and radio items. NO JUNK! EACH PIECE IS GUARANTEED TO BE BRAND NEW. LIMITED QUANTITY. ..... $3.50
20 LBS. .....

METERS
HALLICRAFTERS "S" METER: 3" rd. Illuminated scale 0-5 MA basic movement calibrated to 40 DV over S-9. New in box. ..... $4.95
METERING KIT: Contains 0-10 MA meter and 10-2 MA meter. With test leads and plugs. Built into beautiful, black crackle finish case. In excellent cond. ..... $3.95

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the company claims, could, as it now stands, replace all standard indoor antennas. In time, with further developments, they claim that it will replace practically all of the outdoor type antennas. The magnetic core assembly, although small in size, does have extremely high "Q" and with its highly concentrated flux density makes an effective pickup unit for TV signals.

Measuring only 14" x 6" x 4" with no protruding rods, it is enclosed in a decorative cabinet.

### POWER SUPPLY KIT

*Heath Company*, a subsidiary of *Daystrom, Inc.*, Benton Harbor 15, Michigan, is marketing a variable-voltage power supply kit, the Model PS-3.



Designed for both laboratory and service shop application, the unit provides hum-free d.c. output for "B+" and 6.3 volts a.c. at 4 amps for filaments. The output is continuously variable from 0 to 500 volts d.c. at no load. The supply is linear from 0 to 10 ma. at 450 volts d.c. and 0 to 130 ma. at 200 volts d.c. The output voltage or current is monitored on a large 4½" meter.

High-voltage d.c. and low-voltage a.c. are isolated from ground for use with a.c.-d.c. circuits or to furnish a negative voltage value with respect to a test chassis.

### NEW TV TUBE

*Sylvania Electric Products Inc.*, 1740 Broadway, New York 19, N. Y., has announced a new tube type, the 6BC8, a miniature 9-pin, medium-mu dual triode with semi-remote cut-off characteristics.

The tube lends itself to applications as a cascode amplifier in v.h.f. television tuners and provides more satisfactory performance in a.g.c. systems under both strong and weak signal conditions.

According to the company, the new tube provides relief from objectionable cross-modulation effects when reception of a weak signal is degraded because of strong adjacent-channel station interference. This effect is minimized because the transfer curve of this tube approaches the desirable square law characteristic, which is the optimum shape for minimizing cross-modulation.

### LINEAR AMPLIFIER

*Central Electronics, Inc.*, 1247 W. Belmont Avenue, Chicago 13, Ill., has developed a broadband linear amplifier which covers all bands, 10 through 160 meters, by single-knob bandswitch.



The Model 600L uses newly-developed bandpass r.f. couplers which results in the complete elimination of tuning controls. The amplifier tube is a single 813 operating in class $AB_2$ and requires only 4 watts peak envelope drive power for 500 watts of d.c. power input. The manufacturer claims a useful peak envelope power output of 600 watts on SSB, AM, PM, and CW with very low intermodulation distortion.

### VIDEO PROBE METER

*Research Invention & M'f'g Co.*, 617 F Street, N. W., Washington 1, D. C., is in production on a unique, compact test instrument which can be used for checking television receivers and signal tracing radios.


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Study Color Television Servicing from the very source of the latest, up-to-the-minute Color TV developments. Train under the direction of men who are experts in this field. Take advantage of the big future in Color TV through RCA Institutes' Home Study Course, which covers all phases of Color Servicing. It is a practical down-to-earth course in basic color theory as well as how-to-do-it TV servicing techniques.

This color television course was planned and developed through the efforts of instructors of RCA Institutes, engineers of RCA Laboratories and training specialists of RCA Service Company. You get the benefit of years of RCA research and development in color television.

Because of its highly specialized nature, this course is offered only to those already experienced in radio-television servicing. Color TV Servicing will open the door to the big opportunity you've always hoped for. Find out how easy it is to cash in on Color TV.

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*Engineers' Scope*

**FREQUENCY RANGE:**

a. Vertical Amplifier:
   1. DC to 2.5 MC, 3db Down, with Band Width Switch in Narrow position.
   2. DC to 5 MC, 3 db Down, with Band Width Switch in Wide position.

b. Horizontal Amplifier: DC to 500 KC, 3 db down.

c. Sweep Circuit Oscillator: 2 cycles to 30 KC.

d. Fixed Sweep Frequencies: 30 cycles and 7875 cycles.

**INPUT IMPEDANCE:**

a. Vertical Amplifier: 2.2. Megohms—50 MMF.

b. Horizontal Amplifier: 2.2 Megohms—50 MMF.

**DEFLECTION SENSITIVITY:**

a. Vertical Amplifier:
   1. .010 RMS Volts/Inch with Band Width Switch in Narrow position.
   2. .035 RMS Volts/Inch with Band Width Switch in Wide position.

b. Horizontal Amplifier:. 075 RMS Volts/Inch.

**SPECIAL FEATURES:**

a. Illuminated, Calibrated Screen backed with a green filter for reducing incidental illumination in the room—for accurate measurements and comparisons.

b. Built-In Calibrated Voltages: Peak-To-Peak—100, 10, 1, .1 Volts. Ideal for Observation of Color Burst at 3.58 MC.

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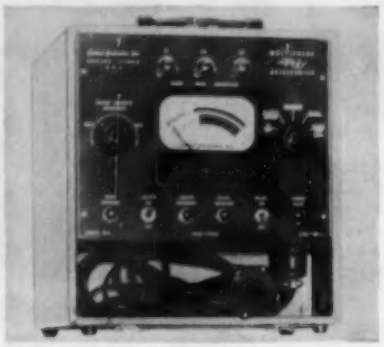

The device is a broadly tuned probe and absorption meter which is designed to pick up general frequencies associated with a TV or radio set such as local oscillator, i.f., video, horizontal oscillator, and output.

The attachable pick-up coil can be used for either 22 or 44 mc. i.f.'s. The probe, which can be held in one hand, incorporates a 0-500 volt d.c. (22,000 ohms-per-volt) *Triplett* meter which is inset in the top of the probe for easy reading.

A data sheet describing the operation of the probe is available on request.

### CRT REJUVENATOR

*Central Electronics, Inc.*, 1247 W. Belmont Avenue, Chicago 13, Ill., has recently introduced a new cathode-ray



tube rejuvenator which has been tradenamed the "Multiphase Rejuva-Tube."

Available in both kit and factory-wired form, the new unit tests, repairs, and rejuvenates all types of electrostatic and electromagnetic TV picture tubes without the necessity of removing the tube from the set, according to the company.

The tester detects open or shorted elements and leakages as high as 3 megohms between elements. A special metered circuit removes "particle" shorts between cathode and heater.

Write the manufacturer for a manual on CRT rejuvenation using the "Rejuva-Tube."

### COMMUNICATIONS RECEIVER

*The Hallicrafters Company* of Chicago has added a new and inexpensive receiver to its line of communications equipment, the Model SX-99.

The receiver has 7 tubes plus a rectifier and covers the standard broad-



cast band in addition to three short-wave bands from 1680 kc. to 34 mc. The set features over 1000 degrees of calibrated bandspread over the 10, 11,


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**MOBILE DYNAMOTORS**

**Made by PIONEER GEN-E-MOTOR**

Compact, efficient dynamotors designed for commercial services. Filter boxes attached to bottom of dynamotors contain A and B filters, oil condensers and RF filters. Dynamotors have internal cooling fans. Ideal for taxi, aircraft, marine and amateur services. Fully guaranteed.

**5.5 TO 6 VOLT DC INPUT**

| OUTPUT | ICAS* | CCS* | FILTER | PRICE |
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| 400 V DC | 275 ma | 175 ma | with | $19.95 |
| 500 V DC | 300 ma | 200 ma | with | 22.95 |
| 500 V DC | 300 ma | 200 ma | less | 19.95 |
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**11.5 TO 12 VOLT DC INPUT**

| | | | | |
|---|---|---|---|---|
| 400 V DC | 275 ma | 175 ma | with | 17.95 |
| 500 V DC | 300 ma | 200 ma | with | 21.95 |
| 500 V DC | 300 ma | 200 ma | less | 18.95 |
| 400 V DC | 175 ma | ..... | less | 9.95 |
| 210 V DC | ..... | 40 ma | less | 4.95 |

*ICAS—Inter. Duty *CCS—Cont. Duty

**MOBILE RELAY**

6 VDC Coil SPST, 50 amp contact for Dynamotor starting plus extra contacts for silencing receiver, SPST normally closed. Made by Struthers Dunn. Specially priced at .... **89¢ ea.**

**WESTON MODEL 506**

2" Round, Bakelite Case. Panel Meter. 100-0-100 Microamperes DC ..... **$4.95** ea.

**GLOBAR NON-INDUCTIVE RESISTORS**

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| 0 ohm 100 Watt | 6 for | $1.45 |
| 35 ohm 25 Watt | 5 for | .98 |
| 350 ohm 100 Watt | 6 for | 1.95 |

**OIL CONDENSER SPECIALS**

Brand New. Ceramic Ins.

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| 1 MFD | 3000 VDC | $1.65 |
| 6 MFD | 1500 VDC | 1.95 |
| 2 MFD | 2000 VDC | 1.50 |
| 10 MFD | 600 VDC | 1.50 |
| 10 MFD | 1400 VDC | 2.50 |

**EIMAC VACUUM CONDENSERS**

32,000 VDC

12 MMF (VC 12-32) ..... $6.50

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| 2" METERS | | 3" METERS | |
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| 0-4 amp RF | $2.95 | 0-500 Microamps | $5.95 |
| 0-60 ma DC | 2.95 | 0-50 Mill. | 3.95 |
| 0-10 ma DC | 2.95 | 0-80 Mill. | 3.50 |
| 0-15 ma DC | 2.95 | 0-150 Volts AC | 4.95 |
| 0-300 ma DC | 2.95 | 0-15 Volts DC | 4.95 |
| 0-10 amps RF | 2.95 | 0-1.5 Mill | 3.95 |
| 0-10 amps DC | 2.95 | 0-1 amp RF | 3.95 |
| **2" METERS** | | 0-50 amps DC | 4.50 |
| 0-200 Microamps | $6.95 | 0-10 Mills DC | 3.95 |
| 0-500 Microamps | 5.95 | 50-0-50 amps DC | 3.95 |
| 0-100 Milliamp | 4.50 | 0-15 amps DC | 3.95 |
| 0-3 Milliamp | 3.95 | | |

**WESTINGHOUSE METER SPECIAL**

Type NX35, 3" round bakelite case.
0-300 MA DC ..... $4.75 ea.
0-500 MA DC ..... 4.75 ea.
(2 FOR $8.95)

**OIL CONDENSERS**

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| 4 MFD—600VDC | $ .95 | 4 MFD—2000VDC | $3.95 |
| 2 MFD—1000VDC | .95 | 8 MFD—2000VDC | 4.95 |
| 4 MFD—1000VDC | 1.25 | 2 MFD—2500VDC | 1.95 |
| 2 MFD—1500VDC | 2.65 | .1 MFD—7500VDC | 1.75 |
| 8 MFD—1500VDC | 2.65 | .00025 MFD—25KV | 9.50 |
| 3 MFD—2000VDC | 2.95 | 8 MFD—660VAC | 1.95 |

**G. E. RELAY CONTROL**

(Ideal for Model Controls, Etc.)

Contains a sigma midget 8,000 ohm, relay (trips at less than 2 MA), high impedance choke, bimetal strip, neon pilot and many useful parts. The sensitive relay alone is worth much more than the total low price of ... **$1.25** Each 10 for **$9.90**

WIRE WOUND RESISTOR KIT. 25 popular assorted—5, 10, 20, 50, 100 watt ..... KIT **$1.95**

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| 6 Henry 50 ma chokes | | .85 |
| Erie 500 mmf ceramicons | 10 for | .50 |
| 15V AC relay SPST 15 Amp contacts | | 1.75 |
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| .01 mmf, 1000 VDC Micas | 5 for | .95 |
| .0004 2500 VDC Micas | 5 for | .95 |
| .04 600 V Micas | 5 for | .95 |
| 100,000 ohm, 100 Watt resist. | | .45 |

Min. Order $3.00—25% with Order—F.O.B. New York.

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Phone WOrth 2-5439

15, 20, 40, and 80 meter amateur bands, a separate bandspread tuning capacitor, crystal filter, antenna trimmer, "S" meter, one r.f. and two i.f. stages, and new styling. Audio power output is two watts.

The set is housed in a gray-black steel cabinet with brushed chrome trim and piano hinge top.

### DIELECTRIC HEATER

The Industrial and Scientific Products Division of *Curtiss-Wright Corporation*, Caldwell, N. J., is marketing



a dielectric heater designed for the heating of non-metallic material by molecular friction.

The heater uses r.f. energy to heat such materials as plastics, wood, paper, foods, or chemicals. The equipment has been designed primarily for research, development, and small plant use.

The high-frequency generator is built into a compact, well-shielded metal cabinet measuring 9 x 22 x 24 inches. Objects up to 1 x 6 x 6 inches can be treated. A timer and milliammeter insure reproducible results.

The company will supply additional information on request.

### ARRESTER FOR U.H.F.

*LaPointe Electronics, Inc.*, of Rockville, Conn., has come up with one solution to the problem of arrester loss on u.h.f. with the introduction of its new "Vee-D-X" Type ULA universal lightning arrester.

The completely hermetically-sealed arrester stops up to 50% of the loss of u.h.f. signal, according to the company. The device incorporates patented special low-loss printed circuits which insure efficient operation at u.h.f. by maintaining correct line impedance with low distributed capacity and minimum signal attenuation.

The Type ULA arrester accommodates all popular types of wire; flat, tubular, oval, foam, and open. Information on prices and distributions is available from Dept. C-4 of the company.

### MINIATURE PLUGS AND JACKS

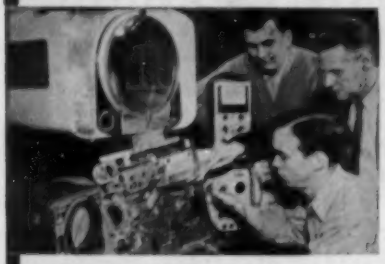
*Switchcraft, Inc.*, 1328 N. Halsted Street, Chicago 22, Ill., is meeting the demand created by the new small size radios, tape recorders, and musical instruments by introducing a line of







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Address.....

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miniature plugs and jacks that are approximately one-half the size of former standard units.

Known as "Tini-Plugs" and "Tini-Jax," the plug design features high-grade insulation throughout, one-piece tip rod-staked into the tip terminal to insure tightness, terminals and body of the plug interlocked to eliminate shifting. The jack features notched insulating washers which mechanically interlock the springs and solder lugs eliminating the probability of shifting resulting in electrical shorts or change in adjustment.

### INDUSTRIAL TV GEAR

The Electronics Division of *Curtiss-Wright Corporation*, Carlstadt, N. J., is now offering a compact closed-circuit television system consisting of three basic units—a camera, control unit with camera control, and a receiver.



The camera measures 8¼" x 6" x 3½" and weighs six pounds. Complete automatic or remote control of the optical system is possible. The camera can thus be panned, tilted, focussed, lens changed, and iris settings made from a remote location. A choice of various accessories is available dependent upon the use desired.

The unit is especially adaptable to checking signatures in banks and department stores, photographing safety deposit box subscribers, identification of personnel from a central file or location, observing customer density, shoplifters, etc., showing inside store scenes as window displays, etc.

A data sheet on this equipment is available on request.

### NEW CAPACITOR LINE

*Illinois Condenser Company*, 1616 North Throop Street, Chicago 22, Ill., has recently added a new type capacitor to its line.

The new Type ITC capacitors have unusually high insulation resistance, low power factor, and long-life performance at high temperatures, according to the company. Their non-inductively wound foil assemblies are oil impregnated and hermetically sealed in steatite cases. They are overload tested and have a standard tolerance of ±20%. Thermoset end seals will not soften or flow with soldering or at any conceivable operating temperature.

The new line is available in capacity ranges from .0005 to 1 μfd. and in

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**Tuneable Booster**

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**NORMAN ELECTRONICS COMPANY**
P.O. Box 733 Brooklyn 1, N.Y.

200, 400, 600, and 1600 volt ratings. Tinned copper leads, 2" minimum length, make for easy soldering.

### SIGNAL GENERATOR

*Electronic Instrument Co., Inc.*, 84 Withers Street, Brooklyn 11, N. Y., has



added the Model 324 signal generator to its line of test equipment in kit and factory-wired form.

The unit can be used for i.f.-r.f. alignment, signal tracing, and trouble-shooting of AM, FM, and TV receivers on fundamentals, as a marker generator for alignment of both the high and low frequency TV i.f.'s, for 400 cps sine-wave audio testing, and for laboratory and experimental work.

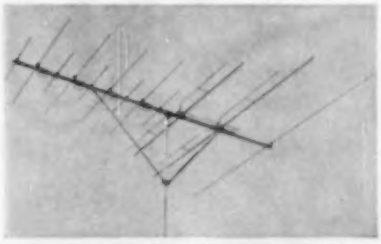
Its frequency range is 150 kc. to 145 mc. on fundamentals in six bands and 111 mc. to 435 mc. on calibrated harmonics. Accuracy of the dial calibration is ±1.5% with a 6:1 vernier tuning knob and excellent spread at the most important frequencies.

The company will supply full details on written request.

### "INTERCEPTOR" ANTENNA

*Winegard Company*, Burlington, Iowa, has been granted a patent covering nine claims for its antenna construction.

The "Electro-Lens Focusing" system



is incorporated in the firm's "Interceptor" antenna. The system uses aligned dipole and unitary directors in an in-line arrangement in which the dipole director serves as a director in both the high and low bands without shielding either the unitary director or the driven element in the high band.

According to the company, this feature has been found highly effective in increasing the gain of the driven element over the entire v.h.f. TV spectrum.

### U.H.F. TV TUNER

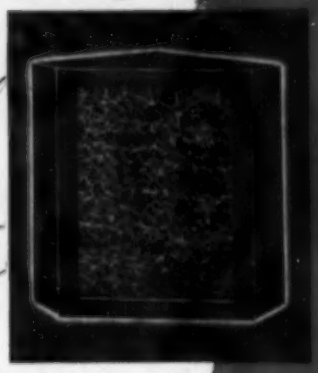
*Radio Condenser Company*, Davis & Copewood Streets, Camden 3, N. J.,


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*brings you all the virtuoso quality your sound system can produce*

TRIM straight lines characterize this smart upright enclosure that fits neatly into a corner. Engineered to present a Stephens speaker system at its best, the "Cavalier" blends unobtrusively with either modern or contemporary settings. Choice of high-lustre, hand-rubbed blonde or mahogany finish. Enclosure Model 626 alone, Net $120.00. 32" wide, 32" high, 21" deep. Shipping Weight 105 lbs.

And a speaker that delivers the most satisfying sound from your hi fi equipment is the Stephens 15" 152AX, a two-way coaxial speaker. Employs two voice coils and 2½ lb. Alnico V permanent magnet, has 5000 cycle network. Shipping Weight 26 lbs. Speaker alone, Net $88.50.

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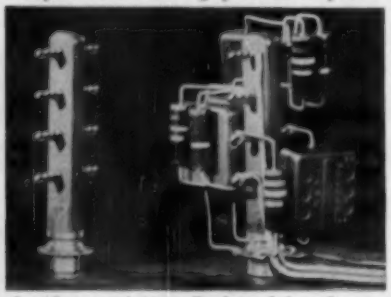

has released a new u.h.f. television tuner which was developed to meet the radio frequency interference objectives of both the RETMA and the FCC.

Designated as the Model T-90, the new tuner features a rearrangement of the usual television tuner components and better shielding which combine to act as oscillator radiation fixes, thereby preventing the oscillator from radiating interference outside the recommended limits.

Bulletin T-90 covering this new unit is available from the manufacturer.

### COMPONENT MOUNTING POST

*Sangamo Electric Company*, Springfield, Illinois, has developed a unique component mounting post to improve



the "bug resistance" of model and production wiring in government and industrial gear.

Tradenamed the "Tote-m-pole," the new unit provides ideal mounting support for small components such as resistors, capacitors, diodes, and transistors at their operating point. Critical leads to grid suppressor resistors, for example, can be reduced to pigtails.

The unit mounts with a single chassis drill hole. It can be reused many times for model mock-up or component replacement. It is adapted to jig wiring practice whether the jig is of cardboard for design study or a production type.

### REPLACEMENT TV TUBES

*Raytheon Manufacturing Company*, Newton 58, Mass., has announced the addition of three aluminized picture tube types to its line of replacement components.

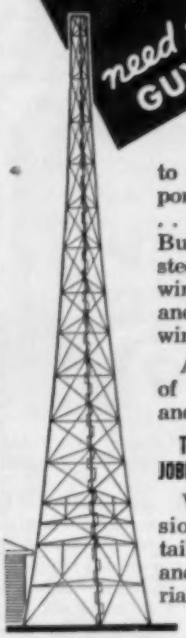
The three new tubes are the 17LP4A, 20DP4C, and 21AUP4A. The 17" tube is a direct-view electrostatic focus and magnetic deflection picture tube. It employs a rectangular filter-glass face plate having a cylindrical front surface for elimination of reflection and a metal-backed screen. The 20" tube is a direct-view magnetic focus and magnetic deflection tube whose other specifications are the same as for the 17" model. The third tube, a 21" unit, is a direct-view electrostatic focus and magnetic deflection tube. In other respects it is the same as the other tubes.

These new units are currently available at the company's distributors.

### DOT-BAR GENERATOR

The Tube Division, *Radio Corporation of America*, Harrison, N. J., has announced the availability of a modified version of its WR-36A dot-bar gen-


STEEL ANTENNA TOWERS need no GUY WIRES



Improve radio and TV reception. Easy to erect . . . self-supporting 3 post towers . . . last a lifetime. Built of galvanized steel sections—no guy wires necessary—safe and resistant to high wind.

Available in heights of 33, 47, 60, 73, 87, and 100 feet.

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More Servicemen buy EICO TUBE TESTERS — in KIT and wired form — than any others sold through distributors. Why? Because EICO gives you the MOST value at LOWEST cost.

- Test all conventional & TV tubes and pilot lights.
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- Line-adjust control. Blank socket for new tubes. Protective overload fuse.

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ELECTRONIC INSTRUMENT CO., INC.
84 Withers Street • Brooklyn 11, N. Y.

erator which can be used for making convergence adjustments in both small-screen and large-screen home color TV receivers.

Owners of the first WR-36A instruments, introduced early in 1954, will be provided with a special kit of modification parts needed for converting these dot-bar generators for use with large-screen receivers. The kits will be available without charge to service dealers and technicians who have returned warranty registration cards on their dot-bar generators to the factory.

### NEW CRYSTAL DIODE

The Electronics Division of *Sylvania Electric Products Inc.*, Woburn, Mass., has announced the development of a new silicon crystal diode, the 1N286, a broadband, coaxial, point-contact type of unit.

The new diode is designed for use as a crystal mixer. Its unique internal geometry makes it possible to cover the band of frequencies from 10,000 to 20,000 mc.

Crystal holders for 10,000-15,000 mc. and 15,000-22,000 mc. are available to house the new diode.

The Type 1N286 is especially adapted to such applications as tunable frequency radar systems and countermeasure devices. This crystal diode is the only product of its type currently available, according to officials of the company. —30—

**Shown here are the movable test equipment racks of Clarence Fisher, Townsend, Montana, radio and TV service shop operator. All the test equipment needed for any repair job is mounted on these channel-iron frame racks on casters so that they may be moved easily about the shop. The test instrument panels are mounted with bolts and wing nuts for easy removal or replacement if desired.**




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★ High Electrical Conductivity
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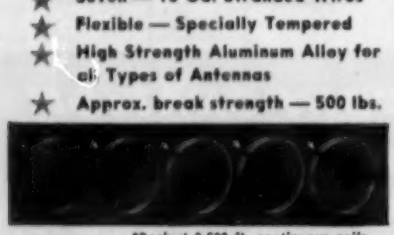
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★ Seven — 18 Ga. Stranded Wires
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★ High Strength Aluminum Alloy for all Types of Antennas
★ Approx. break strength — 500 lbs.



*Packed 2-500 ft. continuous coils per carton marked every 100 ft. with bright red tape.



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NICHOLS

WIRE & ALUMINUM CO.

DAVENPORT, IOWA


## Spot Radio News

(*Continued from page* 18)

Another Congressman, Rep. William Colmer, violently disagreed with the premise that TV should be used. He said that . . . "nothing could bring about more abuse . . ." than to TView . . . "prima donnas . . ." and there were plenty in the House.

TOLL-TV, boxed and pummeled around for years, but somehow always off the mat and able to take more, is now in a grandstand tussle, that will either end in a hail or a wail and the count of ten. For the Commission has finally made up its mind to find out, in a conclusive way, what to do about this business of pay-see TV.

Specifically the FCC invited comments on a series of questions, which asked, in part: What effect will subscription TV have on the broadcast of news . . . What safeguards would be necessary to insure that the public in all areas of the country continued to received well-balanced programs without charge . . . Should subscription TV operations be limited to a single system . . . Should general standards be provided within which a number of systems can be used . . . Should pay-see programs or transmissions be limited to a number of hours per day, or a segment of a broadcast day . . . Should subscription programs be limited only to u.h.f. stations, or to stations in small markets.

The Commission also wanted to know whether subscription television constitutes broadcasting, and if it is not, whether it is to be construed as a common-carrier type of service; they were also anxious to determine if they had the authority to permit subscription TV to employ channels assigned to telebroadcasting. And if, posed the FCC, they do not have the authority to authorize and regulate pay-see TV, then what amendments to the Communications Act would be required, to permit the Commission to supervise the operation.

Those who control the subscription-TV patents were asked to provide all technical data describing the dependability of the equipment to be employed, and the extent, if any, of the degradation to the quality and character of the primary broadcast service, either black-and-white or color. In addition, the Commission wanted to know if any interference could result to other stations on the same channels, adjacent channels, or other pertinent frequencies. And, how would receivers be affected by pay-see operations.

The patent picture was also brought into the scene and the Commission asked what arrangements will be employed for licensing for the competitive manufacture of subscription equipment. The motion picture industry was asked what role they would play, and the networks were also similarly queried.


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Popular Electronics Assortments

This Handy Blue and White Box Means VALUE!



**50 CERAMICON CONDENSERS.** Scoop! Tubular, Disc, Button types. Over 20 values. 4.7 to 4000mmf. Popular mfrs. Wt. 2 lbs. Reg. $13. **$1**

**60 TUBULAR CONDENSERS.** .00035 to 1mf. up to 1600V. Pop. mfrs. and sizes. Wt. 1 lb. Reg. $10. **$1**

**25 OIL CAPACITORS.** Bathtub and tubular. .1 to 2mf. @ 600V. Well-known mfrs. Wt. 4 lbs. Reg. $17. **$1**

**10 ELECTROLYTICS.** Tubular and FP units. .8 to 1000mf. Up to 450V. Many multiple sections. Wt. 2 lbs. Reg. $11. **$1**

**50 RF COILS, CHOKES** and slug-tuned coils, for TV, radio, lab. Wt. 1 lb. Reg. $15. **$1**

**60 RESISTORS.** 56 ohms to 20 megs. ½, 1 and 2 watts. Many 5%. Insulated. Wt. ½ lb. Reg. $12.15. **$1**

**50 PILOT LITE SOCKETS.** Builders' special! Screw and bayonet bases. Wt. 2 lbs. Reg. $6. **$1**

**1500 PIECES SPAGHETTI** tubing, lengths 1 to 4"; 10 sizes; fiberglas, cambric, plastic. Reg. $7. **$1**

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**10 RADIO CHASSIS.** 5, 6 & 7 tube punched chassis. New! Workshop must! Wt. 8 lbs. Reg. $8.50. **$1**

**75 KNOBS.** Some worth 25c. TV 7 Radio; push-on, set-screw, nuts, lugs, etc. Wt. 2 lbs. Reg. $8.50. **$1**

**THREE LBS. HARDWARE.** Assorted. Over 1200 pieces; screws, nuts, lugs, etc. Reg. $6.50. **$1**

**12 CONTROLS.** Up to 1 meg. Some w/ switch, some duals. Wt. 2 lbs. Reg. $12. **$1**

**75 TERMINAL STRIPS.** 1 to 10 terms. Screw & solder types. Wt. 1 lb. Reg. $6. **$1**

**50 PADDERS.** Singles, duals, up to 300mmf. Wt. 1 lb. Reg. $9.50. **$1**

**TEN 25 ft. ROLLS WIRE.** Plastic & cloth insulated, solid & stranded. #18 to 24, asstd. colors. Wt. 2 lbs. Reg. $5.50. **$1**

**18 SWITCHES.** Rotary, push, micro, toggle. Experimenters note! Wt. 3 lbs. Reg. $12. **$1**

**25 TUBE SOCKETS.** Up to 9 pin, some w/shield base, some ceramic. Handy shop asst. Wt. 6 lbs. Reg. $6.50. **$1**

**200 COIL FORMS.** 50 sizes & shapes, bakelite & ceramic. Lab. must! Wt. 2 lbs. Reg. $14. **$1**

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**VARIABLE CONDENSER,** dual—15mmf. W/2" drum. Reg. $2.50. **59c** 3 for $1

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Soon after the Commission issued its book of questions, pro and con comments began snowing on Washington. Defending the toll idea, the prexy of one association said that it would . . . "add a new dimension to the entertainment scene which would double or triple activity in New York and Hollywood . . ." In his opinion, this new medium will . . . "greatly expand the employment horizons of writers, composers, actors, directors, musicians, dancers, singers, designers, and all of those who contribute to the creative side of our entertainment."

Continuing his enthusiastic approval, he said that toll-TV will . . . "make available to millions of Americans entertainment which they have never before been able to see in their own homes—complete Broadway plays, the latest films, and the nation's great opera companies—and at only a fraction of the cost of seeing them outside their homes."

But a dim, dim view was taken by the public relations counsel for a joint committee on toll-TV. Appearing before a meeting of the Drive-In Theatres Association, he said that subscription TV would set the stage for a . . . "giant grab of the public domain, which could lead to a ten-billion dollar-a-year combine, tying Hollywood, Broadway, sports, and television together in a powerful monopoly."

Those who control the pipeline into the living rooms of America, he said . . . "will assume total control of everything from Marilyn Monroe to opera at the Met, and major league baseball."

The promotion of toll-TV was attacked as an insidious propaganda campaign well conceived, heavily financed and skillfully executed, which can be explained only in terms of the astronomical stakes involved should such a system be adopted.

OKLAHOMA CITY'S five radio and three television stations recently saved a veteran's life by making a successful emergency appeal for a rare type of blood.

Shortly after noon one recent Sunday, the VA hospital in Oklahoma City admitted a veteran patient. Doctors decided on an emergency operation. And after all preparations were made, it was found that a transfusion would be required. But the blood required was an extremely rare type—B negative—which occurs in only seven out of every hundred persons. No such blood was on hand at the hospital; nor was any available at other medical centers.

It was then decided to make a plea to the public *via* radio and TV. Thirty-two minutes after the announcement was made, a blood donor was on a table next to the operating room, providing the precious blood. And two hours later thirty-four persons with type-B negative blood had rushed to the hospital. But, by that time the operation had been successfully completed.




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**PLATT ELECTRONICS CORP.**
Dept. A, 125 West 17th St., N. Y. 11, N. Y.
PHONE: CHelsea 2-1100


A salute to the stations of Oklahoma City and its loyal listeners and viewers.

**SNAIL-LIKE ACTION** on new station grants still prevailed as this column was being prepared. Congressional inquiries were blamed for the pokey moves.

Many months will pass, it has been generally admitted, before any real drive for station authorizations is made. Firm, conclusive action in Washington could spark action, all agreed.

Stations and new calls OKed, as this issue was being put to press, appear below.

**AMERICA HAS SET UPON A COURSE** of developing her broadcast industry within the framework of the free enterprise system and her concepts of free speech.

Thus declared FCC Commissioner John C. Doerfer, in an address on the dangers of control by goverment, before the Commonwealth in San Francisco, several weeks ago.

Noting that there is a substantial difference between regulation and operation, the Commissioner said that

# NEW TV STATIONS ON THE AIR

**(As of April 25, 1953)**

**The following new stations bring the lists published in previous issues up to date.**

| STATE, CITY | STATION | CHANNEL | FREQUENCY RANGE (IN MC.) | VIDEO WAVELENGTH (IN FT.) | VIDEO POWER (IN KW.) |
|---|---|---|---|---|---|
| Louisiana | | | | | |
| Baton Rouge | WBRZ | 2 | 54-60 | 17.8 | 100 |
| Texas | | | | | |
| Waco | KWTX-TV | 10 | 192-198 | 5.08 | 107 |
| Canada | | | | | |
| Halifax, N.S. | CBH-TV | 3 | 60-66 | 16.06 | 88.5 |

The frequency of the video carrier = 1.25 + channel lower freq. limit. Total number of TV stations now on the air in U.S.: 433 (120 of which are u. h. f.).

# NEW TV GRANTS SINCE FREEZE LIFT

*Continuing the listing of construction permits granted by FCC since lifting of freeze. Additional stations will be carried next month.*

| STATE | CITY | CALL | CHANNEL | FREQUENCY | POWER* |
|---|---|---|---|---|---|
| Idaho | Lewiston | ..... | 3 | 60-66 | 1.46 |
| North Carolina | New Bern | ..... | 13 | 210-216 | 40 |
| Pennsylvania | Sunbury | ..... | 38 | 614-620 | 12.9 |

**NEW CALL LETTER ASSIGNMENTS**

| STATE | CITY | CALL | CHANNEL | FREQUENCY |
|---|---|---|---|---|
| Arkansas | Jonesboro | KBTM-TV | 8 | 180-186 |
| D. C. | Washington | WETV | 20 | 506-512 |
| Georgia | Savannah | WSAV-TV | 3 | 60-66 |
| Hawaii | Hilo | KHBC-TV | 9 | 186-192 |
| " | Wailuku | KMAU | 3 | 60-66 |
| North Carolina | Washington | WITN | 7 | 174-180 |

**CALL LETTER CHANGES**

| | | | | |
|---|---|---|---|---|
| Idaho | Boise | KBOI-TV (Formerly KBOI) | 2 | 54-60 |
| Pennsylvania | Pittsburgh | KDKA-TV (Formerly WDTV) | 2 | 54-60 |
| Wisconsin | Milwaukee | WKIX (Formerly WOKY-TV) | 19 | 500-506 |

*ERP=(effective radiated power, kw.) ..... Call letters to be announced


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| 14BP4 | 12.95 | 17HP4A | 16.95 |
| 16AP4A | 16.50 | 17LP4A | 16.95 |
| 16GP4A | 16.50 | 19AP4A | 19.95 |
| 16KP4 | 13.95 | 20CP4A | 18.95 |
| 16RP4 | 13.95 | 21AP4A | 21.95 |
| 16TP4 | 13.95 | 21EP4A | 19.95 |
| 16CP4A | 15.50 | 21FP4A | 20.95 |

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the primary design of the regulatory process is to . . . "curb excessiveness and prevent unreasonable discriminatory practices . . . and operation means management. . . .

"In America," Doerfer explained, "management is reserved for private individuals, courageous enough to risk their energy and their savings."

A number of persons, although opposed to government operation of a broadcasting system, languish for stricter controls or more censorship, members of the club were told. Reminding his listeners that we can just as easily and irretrievably lose some of our cherished freedoms through inadvertence, as we can through intentional abandonment, the Commissioner said that we can gain nothing by compromising these fundamental principles.

A poignant observation, indeed. . L.W.

## NORTH FORK MEET

THE North Fork Amateur Radio Club of Western Oklahoma will hold its third Annual Hamfest and Picnic at the Quartz Mountain State Park and Lugert Lake, on May 21st and 22nd.

Registration fees will be $2.50 and will include overnight bunkhouse privileges, as well as eligibility for an impressive list of prizes.

All those who register prior to May 15th will be eligible to compete for an extra prize of a completely wired and tested Johnson "Adventurer."

Those wishing further details on this event are asked to contact Jay Thompson, W5ZZP of Sayre, Oklahoma. —30—

## ST. LOUIS HAMFEST

THE Greater St. Louis Radio Amateur's Annual Hamfest has been scheduled for Sunday May 22nd this year.

The committee in charge has planned an interesting program consisting of games and entertainment with plenty of good prizes for the lucky contest winners.

Refreshments will be available at the Creve Coeur Farmer's Club where the event will take place. Admission for adults is $1.00 per person with children being admitted free.

Those desiring further information on this event should get in touch with Lawrence Schwarz, 7 North 7th Street, St. Louis 1, Missouri who is serving as publicity chairman for this event. —30—

## SPEAKER SERVICE HINT

By WILLARD S. WEISS

HERE is one way to locate those elusive speaker troubles.

Occasionally, a loudspeaker may become noisy and rattle due to such things as a loose eyelet where the voice coil wires are attached to the cone, "unstuck" glue, etc.

A quick way to find such trouble is to energize the speaker with some frequency at which the noise can be heard. Then, by using a piece of rubber tubing held to your ear with the other end near the cone, the trouble can usually be isolated.

A medical stethoscope, if available, can be used for the same purpose as the tubing. —30—


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| 1H5GT | .51 | 6AX5GT | .60 | 6J6 | .61 | 12AT7 | .71 |
| 1L4 | .51 | 6BA6 | .58 | 6K6GT | .39 | 12AU6 | .43 |
| 1L6 | .51 | 6BA7 | .58 | 6K7 | .40 | 12AU7 | .58 |
| 1LC6 | .49 | 6BC5 | .48 | 6L6 | .78 | 12AV7 | .73 |
| 1N5GT | .51 | 6BE6 | .46 | 6Q7 | .40 | 12AX4GT | .60 |
| 1X2 | .65 | 6BF5 | .48 | 6S4 | .41 | 12AX7 | .61 |
| 2A3 | .35 | 6BG6G | 1.18 | 6S8GT | .65 | 12AZ7 | .65 |
| 2A7 | .35 | 6BH6 | .51 | 6SA7 | .45 | 12B4 | .72 |
| 3Q5GT | .61 | 6BJ6 | .51 | 6SK7GT | .45 | 12BA6 | .45 |
| 3V4 | .48 | 6BK5 | .75 | 6SL7GT | .60 | 12BA7 | .58 |
| 5V4G | .49 | 6BK7 | .78 | 6SN7GT | .60 | 12BE6 | .46 |
| 5Y3GT | .30 | 6BN6 | .90 | 6SQ7 | .40 | 12BH7 | .61 |
| 5Y4G | .40 | 6BL7GT | .78 | 6T8 | .71 | 12BY7 | .65 |
| 6A8 | .40 | 6BQ6GT | .83 | 6U8 | .76 | 12BZ7 | .63 |
| 6AC7 | .65 | 6BY5G | .60 | 6V3 | .80 | 12SA7 | .45 |
| 6AH4GT | .65 | 6BZ7 | .95 | 6V6GT | .48 | 12SL7GT | .60 |
| 6AK5 | .96 | 6C4 | .41 | 6W4GT | .43 | 12SK7 | .45 |
| 6AL5 | .43 | 6CB6 | .51 | 6W6GT | .53 | 12SN7GT | .56 |
| 6AQ5 | .48 | 6CD6G | 1.63 | 6X4 | .37 | 19T8 | .71 |
| 6AR5 | .48 | 6CU6 | .95 | 6X5GT | .38 | 25BQ6GT | .82 |
| 6AU5GT | .60 | 6F6 | .42 | 6X8 | .80 | 25CU6 | 1.00 |
| 6AV5GT | .60 | 6F5GT | .44 | 7T8 | .49 | 25Z5 | .55 |
| 6AV6 | .37 | 6H6 | .50 | | | | |

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| 35C5 | .48 | 50L6GT | .50 |
| 35L6GT | .41 | 117L7GT | 1.20 |
| 35W4 | .33 | 117Z3 | .33 |
| 35Y4 | .42 | 117Z6GT | .65 |
| 35Z5GT | .33 | 80 | .40 |
| 50A5 | .49 | 1629 | .39 |

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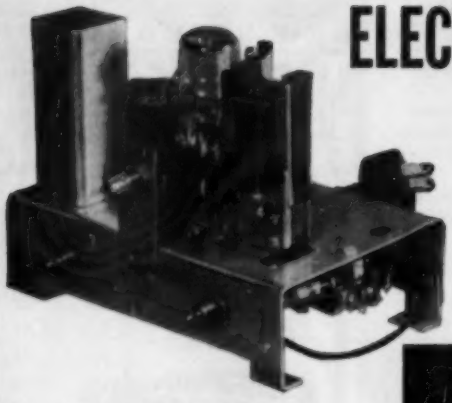
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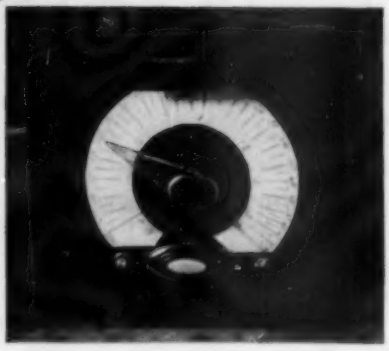




# ELECTRONIC TIMER FOR PHOTO ENLARGER



Top chassis view of the unit. Note how potentiometer, $R_1$, is mounted above the chassis. See text.



Over-all view of the home-built timer. The dial is calibrated in minutes and seconds. A shielded red bulb lights the dial face.


By

**DORIS and DARYL WILEY**


*Construction details on a fairly simple unit which covers range from two seconds to over three minutes.*

WHEN making several prints from one negative, it is easy to become confused and to make each one different, spoiling a number in the process. However, by using the reliable and very accurate electronic timer shown in the photographs your worries are over. Merely set the dial to the correct exposure, press the button, and do another chore while the timer thinks for you and automatically shuts off the enlarger. Each print will be exactly the same for that particular setting of the dial, whether you set it for ten seconds or for three or four minutes—this timer never varies.

This circuit is patterned after the *Nema IA* timer which is used in welding controls, the main difference being in the time constant of the grid circuit.

When the unit is turned on and $A$ is negative with respect to $B$, current flows through $R_5$ from cathode toward the grid, thus charging $C_1$. The charge on $C_1$, being negative toward the grid, is determined by the voltage divider arrangement of $R_1$ and $R_2$. (See Fig. 1.)

This phenomenon, known as grid conduction, occurs only during half of the cycle, and keeps $C_1$ charged to the proper potential and polarity until contact is made with the push-button, $S_1$.

This operation then starts the timing cycle. When contact is made, relays

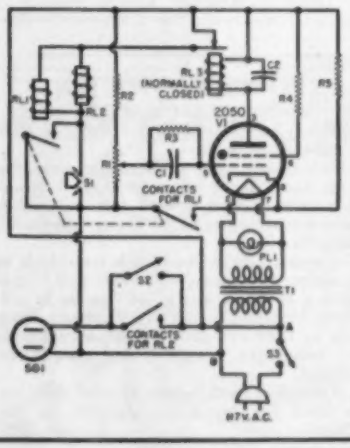



**Fig. 1. Complete schematic diagram of the electronic timer for a photo enlarger.**

*$R_1$—50,000 ohm pot*
*$R_2$—50,000 ohm, ½ w. res.*
*$R_3$—10 megohm, ½ w. res.*
*$R_4$—100,000 ohm, ½ w. res.*
*$R_5$—47,000 ohm, ½ w. res.*
*$C_1$—4.2 µfd. capacitor (Authors used a surplus unit. A 4 µfd., 150 v. bathtub can be used)*
*$C_2$—.1 µfd., 200 v. capacitor*
*$RL_1$—D.p.d.t. a.c. relay, 115 v. (Only d.p.s.t. operation, normally open, is used)*
*$RL_2$—S.p.s.t. a.c. relay, 115 v., normally open*
*$RL_3$—S.p.s.t. d.c. relay, 6 v., normally closed*
*$T_1$—Fil. trans. 6.3 v. @ 1 amp.*
*$S_1$—S.p.s.t., normally open, push-button switch*
*$S_2$, $S_3$—S.p.s.t. toggle switch*
*$SO_1$—Female receptacle*
*$PL_1$—#47 pilot light*
*$V_1$—2050 tube*

$RL_1$ and $RL_2$ close. Part of $RL_1$ completes the cathode circuit to $R_1$. The other contacts on $RL_1$ close across the push-button contacts, $S_1$, to complete the relay coil circuit, and $RL_2$ turns on the photographic enlarger. Capacitor $C_1$ now discharges through the 10 megohm resistor $R_3$ across it, until the potential of the grid is low enough to allow the tube to conduct.

Upon conduction of the tube, relay $RL_3$ energizes due to the plate current through it, which opens the relay coil circuit for $RL_1$ and $RL_2$. At this instant the enlarger is turned off and capacitor $C_1$ recharges to the set potential of $R_1$.

Capacitor $C_2$ is connected across the $RL_3$ relay coil in order to keep it from chattering due to the pulsating d.c. current through it.

Before constructing this unit, first decide on your parts layout for most economical utilization of the allotted space.

Cut all chassis holes before mounting any of the parts.

Next mount the parts. (Mount the push-button and pilot light on the cabinet, if desired.) It is best to mount the 50,000 ohm potentiometer about 2 inches above the chassis on a special extension so that the dial and pointer can have nearly a full circle swing.

Wire according to the schematic. For best results, start with the line cord and follow through. Solder all connections well.

One of the "on-off" switches is necessary to turn on the unit, and the other is used to bypass the relays to turn on the enlarger for focusing, sizing, and getting ready to expose the print.

Plug a lamp into the enlarger outlet and plug the unit into the home outlet for a thrilling test. Build a suitable cabinet and finish it as you desire.

The ideal pointer is made by forming a piece of lucite to desired shape, scoring a line up the center of the back and filling with black paint. Glue this to an ordinary radio knob.

Fasten the completed unit into the cabinet with screws from the bottom as is done in small radio installations.

To make the dial, place a circular piece of heavy white paper in place and calibrate. Use a clock or watch with a good second hand and check twice for accuracy. You will probably wish to remove this paper for completion of dial calibrations. Be sure to mark its position exactly before removing it, so it can be replaced in the same location.

Form the reflector from metal and place it and the pilot light over the calibrated dial. Buy a red bulb or paint one red.

Put hooks on the back of the cabinet if you wish to hang it up. Hang it on the wall near your enlarger, set the dial, press the button, and you have a perfect print every time!

Considering the simplicity of this device and the relatively-low cost of the required parts, this timer has a lot to offer the serious photo fan who enjoys enlarging his own choice prints. —30—


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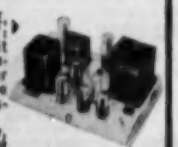
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## A Two-Band Final

(*Continued from page* 51)

partitions or the chassis. Initially, $RL_1$ was mounted on a piece of ⅝-inch Lucite, which was mounted on the chassis. The shielding cabinet was built of *Reynolds* "Do-it-Yourself" aluminum sheet, using *Reynolds* one-inch aluminum angle for supports. These materials are soft aluminum, and are a pleasure to work with, compared with dural, and construction of the cabinet and tapping of all holes took up only one afternoon. The aluminum angle is tapped, and 6-32 machine screws are used to screw the panel, top-and-side cover, and back cover to the angle. The top-and-side cover was bent, using a hammer and 2 by 4, from one piece of aluminum and allows ¾-inch overlap on each side of the chassis. The rear cover has the same overlap.

When the rig was first fired up at 1000 volts, everything was fine. 1800 volts was tried next, and nothing blew up. At 2500 volts, there was a loud "pop," and smoke started pouring out. The trouble was found to be in the relay mounting system. The combination of 2500 volts d.c. and the unknown amount of r.f. appearing on the hot ends of the tank circuit had resulted in a voltage rupture of the Lucite, from the relay to chassis ground. The consequent fire ruined the relay. A new relay was installed on some one-inch stand-offs and the final was fired up again—successfully, this time. At least, it was successful on 14 mc. However, on 7 mc., the amplifier would not neutralize correctly, and a few minutes of operation with plate voltage applied, in an effort to find the trouble, resulted in more smoke. This was traced to the plate r.f. choke, which evidently had a hot spot at 7 mc., despite being rated by the manufacturer for the ham bands. Substitution of $R_5$ for the choke cured this difficulty and the final neutralized properly on both bands.

Initially, no parasitic suppression measures other than the incorporation of $C_5$ and the use of copper strap leads in plate and neutralizing circuits had been taken. No parasitics evidenced themselves while operation was conducted on both bands for a few days. Then, a careful check for parasitics was made. First, antenna and excitation were disconnected, the amplifier was run at 2500 volts, and bias was reduced to about 220 volts, at which point the plate current was 150 ma. Plate and grid tuning capacitors were run throughout their ranges with no grid current flow and no changes in plate current noticed. Next, the plate voltage was reduced to 700, and the grid-bias lead was grounded. This resulted in about 500 ma. of plate current, as well as some weird and wonderful variations in plate and grid current, when the earlier tuning tests were repeated. Since I hoped to use


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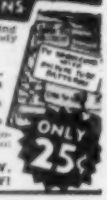
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this rig as an amplifier for a single-sideband rig, the parasitics had to go. Therefore, three parasitic-suppression measures were taken. The grid suppressor, $R_2$-$L_2$, was added, a 50,000-ohm resistor, consisting of several paralleled 2-watt non-inductive resistors, was connected across the grid coil, and three paralleled 33-ohm, 2-watt resistors were inserted between the grid and the neutralizing capacitor. Clipping and unclipping leads proved the two latter measures to be unnecessary. The series grid suppressor was required, but cut the grid current by some forty per-cent. Removal of $C_2$ brought the grid current up to within ten per-cent of its former value, and the amplifier still was completely stable. (No, I don't know why, either. Checks with a grid-dip oscillator showed no untoward resonances with $C_2$ in or out of the circuit.)

One other difficulty manifested itself with this rig. It had been planned to operate the final into an external antenna coupler, which has moderately variable antenna loading control, and it was decided that variable-link coupling to $L_2$ was unnecessary. This was an unfortunate error, as it was not possible to reduce coupling sufficiently with the original $L_2$ to permit legal inputs on either band, when operating into flat 52-ohm lines. If I could figure out some way to do it within the limited confines of the shield can, I would substitute a 1000-watt coil with variable-link coupling (which should be controllable from the front panel) for the present $L_2$-$L_3$ setup.

Aside from the difficulties mentioned, the rig has been quite satisfactory. When operated through a low-pass filter and an antenna coupler, it causes no TVI in my own receiver. However, a day or so after steady operation was started with the full kilowatt, my next-door neighbor complained that his set lost its picture each time the key was pressed. A check showed that this was happening on all channels. This was a puzzler, as a test with other neighbors revealed their sets to be clear of TVI, and his trouble was not coming from r.f. in the a.c. line, nor from front-end overloading. Then I noticed that his house and mine were fed by a common power line. His line voltage showed a drop of nine volts when my key was pressed. This drop, when taken from our normally low line voltage was sufficient to pull the local oscillator in his set completely out of oscillation every time the key was pressed. That, unfortunately, is just another of the ill effects of high power. Now I run the kilowatt only when the line voltage is high, but even then, it's nice to be able to change bands as quickly in the final as I can in the exciter.

For those who enjoy contest work or want the convenience of rapid band-changing, this circuit is well worth the small investment of time and effort that is required to build up this amplifier. Try it for smooth operating convenience. —30—


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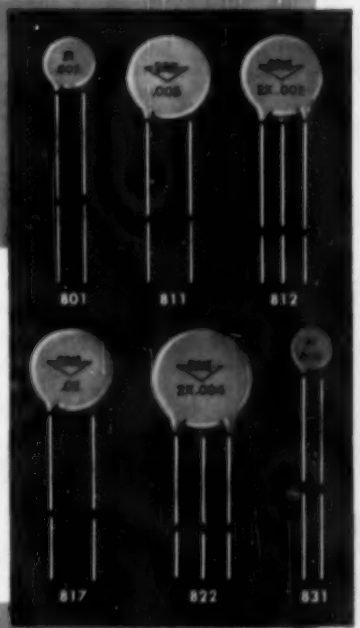

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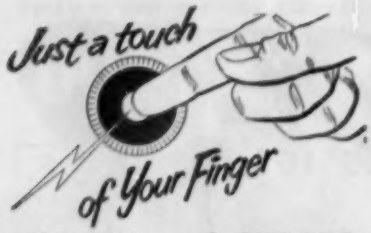
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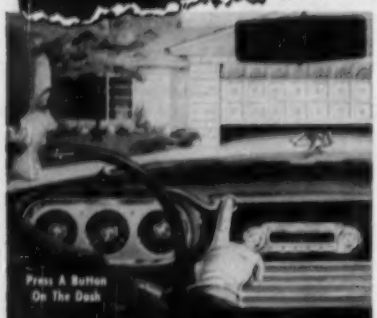
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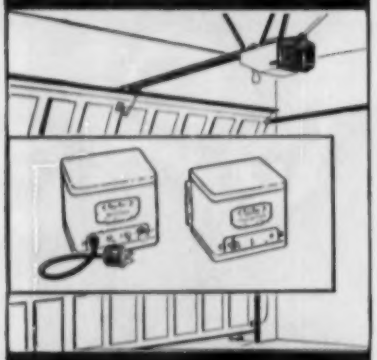

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# Manufacturers' Literature

**The bulletins reviewed in this section are for your convenience; unless otherwise indicated they are available to all our readers. For prompt attention write directly to the manufacturer for literature described.**

### DYNAMOTOR CATALOGUE

*Carter Motor Company*, 2644 N. Maplewood Ave., Chicago 47, Illinois, is now offering copies of its latest dynamotor catalogue which lists the firm's entire 1955 line.

In 28 pages, the catalogue provides complete electrical and mechanical specifications and is designed both for the counter salesman and service and purchasing departments.

Copies of the new catalogue are available from Dept. 5 of the company upon written request.

### TUBE TESTER CHART

*Electronic Instrument Co., Inc.*, 84 Withers St., Brooklyn 11, N. Y., has just issued a new 1955 tube tester roll chart, #625-04, which contains hundreds of listings of the latest tubes just released by all leading tube manufacturers.

Designed to be used with all *Eico* tube testers, the chart is available at $1.00 from the company's jobbers or may be ordered from the company direct.

### TECHNICAL DATA CATALOGUE

*Lefax Publishers*, Philadelphia 7, Pa. has issued a newly-revised catalogue covering its pocket-size technical library.

Among the books listed in the catalogue of particular interest to those in the radio-electronic field are data books on mathematics, radio, television and FM, a.c. and d.c., a.c. motors and generators, transformers, relays, and meters.

For a copy of the catalogue, write the publisher direct.

### TRANSFORMER CATALOGUE

A 20-page catalogue which has been designed to facilitate the custom-specifying of transformers by industrial purchasers and design engineers has been issued by *General Transformer Company*, 18240 Harwood Ave., Homewood, Ill.

The catalogue illustrates "prototypes" covering the complete range of transformer applications to make it easier and simpler to specify electrical and mechanical requirements.

### RMS CATALOGUE

The Catalogue Division of *Radio Merchandise Sales, Inc.*, 2016 Bronxdale Ave., New York 62, New York is now offering copies of its 1955 cata-


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logue covering the company's line of antennas and accessories.

This handy 25-page catalogue, No. 55A, is punched for insertion in standard ring binders. The publication carries list prices for each item shown and groups the entire line into various sections for ease in ordering. The catalogue is completely indexed.

### TRANSISTOR DATA SHEET

*General Transistor Corp.*, 95-18 Sutphin Blvd., Jamaica 35, N.Y. has released a new catalogue sheet covering its line of diffused *p-n-p* junction transistors.

The data sheet illustrates the company's double sealing process and provides information on absolute maximum transistor ratings and characteristics.

### CABINETS AND EQUIPMENT

*General Industrial Co.*, 5725 N. Elston, Chicago 30, Illinois has issued a colorful 24-page catalogue which is available for the asking.

Among the many new items listed in the catalogue is a wireless intercom system which requires no wires and no installation. Also offered are plastic drawer cabinets in a wide variety of sizes and capacities. Office equipment and other industrial items are also pictured and described in detail.

### AUTO-RADIO TRANSFORMERS

*Chicago Standard Transformer Corporation*, Addison and Elston Streets, Chicago 18, Illinois, has issued an 8-page auto-radio transformer replacement guide which is being distributed without charge upon request.

The new publication lists both vibrator power and audio output replacements for over 540 car radios. It includes all models used by the major automobile manufacturers as well as private label brands. More than 40 different manufacturers are listed and cross-referenced for easy use. In addition, information about the year each model was used is also included.

A separate catalogue page lists detailed specifications on 25 vibrator power transformers, including 21 exact replacements, and 19 audio output units used in car radios.

### RETMA ANTENNA BOOKLET

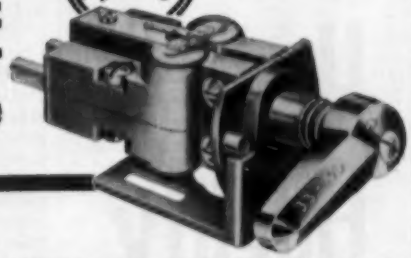
A new consumer education publication, "Your Television Antenna System," has been prepared by the Radio-Electronics-Television Manufacturers Association in cooperation with the National Better Business Bureau.

The booklet is designed to acquaint the public with the importance of antennas for good television reception and the need for keeping an antenna properly serviced. It was prepared by the Antenna Section of the RETMA Parts Division and the Radio-Television Committee of the National Better Business Bureau.

Distribution of this booklet will be made through TV dealers, service technicians, and local BBB's. Bulk orders will be filled through the National Bet-


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### INDUSTRIAL TV DATA

The Engineering Products Division, Building 15-1, *Radio Corporation of America*, Camden 2, N. J. has issued a new catalogue describing its industrial television equipment.

Catalogue E.51 illustrates and describes the features, applications, and construction details on the ITV-6 closed-circuit television system. Specifications on this gear are also included.

### HEATH FLYER

*Heath Company*, a subsidiary of *Daystrom, Inc.*, Benton Harbor, Michigan has released a 12-page, two-color flyer describing and picturing the firm's line of test equipment, audio gear, and ham items.

Among the new products are a 100 watt phone-c.w. transmitter, a deluxe high-fidelity amplifier, and a TV alignment generator. Complete specifications and pertinent details are provided for each of the units listed.

A free copy of this publication is available for the asking.

### "REP" DIRECTORY

The New England Chapter of "The Representatives" of Electronic Products Manufacturers, Inc., has issued a 1955 Directory of its membership which is currently being distributed to the trade and industry in general.

The directory lists, by name, the manufacturers represented by participating members of the New England Chapter as well as the various categories of products these manufacturers offer.

For information on how a copy of the directory may be obtained write to the chairman of the directory committee, Henry P. Segel, 131 Newbury Street, Boston 16, Mass.

### GUIDE FOR TECHNICIANS

*Astron Corporation*, 255 Grant Avenue, East Newark, N. J. has just issued a new 16-page capacitor estimating and pricing guide in handy pocket size for the convenience of service technicians.

The guide contains all essential data on all of the firm's capacitor types for replacement in home radio, phonograph, and television equipment. List prices are given to enable the technician to make on-the-spot estimates and show customers actual costs.

The guide is available through jobbers or from the company direct.

### GUARDIAN RELAYS

*Guardian Electric Mfg. Co.*, 1621 W. Walnut Street, Chicago 12, Ill. is now offering copies of its new 72-page catalogue which covers the firm's complete line of basic type relays.

Each relay is fully described as to physical and electrical characteristics


INSIST ON THE GENUINE **NEW INCA QUICKIE** #3

**the 10 WAY WRENCH** WITH 1,001 USES!

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(This picture is now being used by "Merchants" who misrepresent the product they are selling. They remove "INCA" and "Made in Switzerland" from their illustrations, and sell inferior items with none of the above features).

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with complete operating data and suggested applications also included. In addition to the relays, the book devotes two pages to definitions of engineering and electrical terms and laws.

### CAPACITOR CATALOGUE

*Good-All Electric Manufacturing Co.*, Ogallala, Nebraska has announced the availability of a new two-color, 32-page catalogue which describes its entire line of paper and dielectric capacitors for civilian, military, and specialty applications.

Catalogue No. 551 includes line drawings and photographs of all case style mountings, graphs and charts describing electrical and mechanical characteristics, as well as a comprehensive index which facilitates ordering.

### ATLAS SOUND DATA SHEETS

*Atlas Sound Corp.*, 1451 39th Street, Brooklyn 18, N. Y. has released two catalogue sheets covering two of its new products, the Model CJ-30 "Cobra-Jector" loudspeaker and the Model BS-37 "Porto-Boom" professional mike boom stand.

Either or both of these data sheets are available without charge upon request.

### TV TUBE GUIDE

The second edition of its "Reference Guide for Television Picture Tubes" has been announced by *CBS-Hytron* of Danvers, Mass.

This newly enlarged guide lists all magnetically deflected picture tubes—monochrome or color—including those made by other manufacturers as well as *CBS-Hytron*. As an additional aid to the TV technician, bold-face type emphasizes the important characteristics among similar tubes having different suffix letters.

Copies of the guide are available from the company's distributors.

### SYLVANIA BROCHURES

*Sylvania Electric Products Inc.*, 1100 Main Street, Buffalo 9, N. Y. has announced publication of three new brochures in the electronics field.

The first is a wall chart which lists the company's complete line of 600 ma. tubes for series-string television receivers. The second brochure lists gas tubes for use in control mechanisms, while the third folder covers crystal diodes.

Any or all of these publications are available from the Central Advertising Distribution department of the company.

### METAL HOUSINGS

*Premier Metal Products Co.*, 3160 Webster Ave., New York 67, N. Y. has released its 1955 catalogue covering the firm's complete line of "Precision Built Metal Housings."

Tabbed for easy reference, the 16-page catalogue illustrates over 450 standard stock metal housings for the electronics industry. It includes full details on many newly-designed items not found in previous catalogues. —30—


## ARMY AIRCRAFT RECEIVER . . . BC-946B

Covers 520 Kc to 1500 Kc Broadcast Band. Tubes: 3-12SK7, 1-12SR7, 1-12A6, 1-12K8. Designed for dynamotor operation; can be easily converted to 110 volt or 32 volt use. Two IF stages. Three-gang tuning cond. BRAND NEW, in sealed carton, with tubes, less dynamotor . . . . . $29.95

12 volt dynamotor for above . . . . . $7.95

## A-966 DYNAMOTOR

Can be easily converted to a four speed motor. Approx. 11" long, 1/20th horsepower, 115 V, 50/60 cycle, AC motor with integral gear box having four ¼" drive shafts turning simultaneously at the following speeds: 4000 RPM—grinders, buffers, flexible shaft tools, etc.; 150 RPM—wrapping fishing rods, slow speed tools; 25 RPM—dev. tray rocker for photo darkroom; 5 RPM—turning barbecue spits, adv. displays.

**A THOUSAND OTHER USES AROUND THE WORK SHOP**

with diagram for conversion to AC . . . . $4.95
Already converted, ready to go . . . . . $7.95

**BC-709 INTERPHONE AMPLIFIER** battery operated, brand new . . . . . $2.95

**Amplifier**, pre-amplifier, or 5 station Intercom. Up to 5 input and output circuits. Requires simple power supply for operation. Complete with tubes in sturdy metal case. Excellent . . . . . $1.95
3 for $5.00

**25 watt phone**—CW 5 tube transmitter. Frequency range 2-9 MC. Two 815 tubes in circuit. One as modulator and one as RF output. Ideal for C. A. P., Mobile. Excellent condition, with tubes. Wt. 24 lbs. With tuning unit 2.3-4.3 . . . . . $12.95

**Wavemeter.** Containing a 105MC to 127 MC tuneable reentrant type resonant cavity and 0-200 Micro Ammeter. Brand New . . . . . $49.50

**Radio Receiver** and 12 Volt DC Vibrapack. 3800kc-6000kc. 7 tube super-het like new. Less tubes . . . . . $12.95

**Radio Receiver** 11-tube UHF tunable 234-258 MC receiver with schematic. Complete with tubes 3 ea. of 6AK5, 7 ea. of 9001, 1 ea. of 12A6. Like new. Control Box, New . . . . . $6.95 . . . . . $1.50

**BC-1206 Beacon Receiver** Complete with 5 tubes, tunes 195 KC to 420 KC. Volume control—RF gain control. Power supply 24 to 28 volts, Wt. only 4 lbs. Brand new . . . . . $10.95

**TS 258** X band freq. meter, power meter & signal generator. Power measuring bridge pulse or CW freq. 8990 MC-9017 MC. Excellent . . . $195.00



Air Force Surplus

**ORIGINAL COST $2500.00**

**Marine or Airborne LOng RAnge Navigational equipment! Determine the exact geographic position of your boat or airplane!**

AN/APN4 Loran set. Frequency range 1700-2000 KC, complete with 1D6B/APN4 indicator, R9B/APN4 receiver, crystal and plugs. Complete . . . . . Brand New $129.50

**R-65/APN-9 LORAN Indicator.** LATEST MODEL UNIT. Complete in one light weight case. Accurate on a maximum range of up to 1600 statute miles, within 1% of the distance from the ground transmitter. The finest unit available at any price!! BRAND NEW. Only . . . . . $295.00

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**INDICATOR UNIT.** For conversion to test scope, panadapter, analyzer, etc. Double deck chassis, 5CP1 mounted in tube shield. Less small tubes, but complete with 5CP1. Exc. cond . . . . . each $9.95

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Brand New . . . . . $4.95

**SOUND POWERED** head and chest sets . ea. $3.95
**LIKE NEW 2 for $7.00**

**PE120.** Used 6, 12, or 24 Volt Power Supply each . . . . . $4.95

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## Command Equipment (274N-ARC5, ATA)

| | As Is | Excellent |
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| 3-6 mc | $4.95 | $7.95 |
| 6-9 mc | 5.95 | 6.95 |
| 3-Rec. Mech | | 1.50 |
| BC 456 Transmitter | 4.95 | 6.95 |
| 459 Transmitter | 5.95 | 7.95 |
| 456 Modulator | 1.95 | 3.95 |

Remote Control box and shaft for above, per set . . . $2.50

BC-457 Transmitter—4 to 5.9 MC . . . . . $6.95
1.5 to 3 MC COMMAND RECEIVER . . . new $14.95, used $ 9.95

**ARC-5/R-28 2 MTR RCVR**—2 meter superhet, absolutely one of the BEST available today! Tunes from 100 to 156 mcs. in four crystal channels. (Easily converted to continuous tuning.) Complete with 10 tubes. Excellent . . . . . $13.95

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NEW $29.50

**APN-1 Magnetic Units.** You can build "Versatile Sweep Frequency Generator." With instructions . . . . . $5.95

**MN-26-C.** Remote Controlled Navigational Direction finder and communications receiver. Manual DF in any one of three freq. bands, 150 to 1500 KC. 24 V. Self contained dynamotor supply. Complete installation, including receiver, control box, loop azimuth control. Left-Right Indicator, plugs, loop transmission line and flex. shafts, oper. & main. manual. Ideal for use in boats, etc.
BRAND NEW . . . . . $49.50
MN-26-B Loop. Brand New . . . . . 6.95
MN-52 Crank drive. New . . . . . 2.95
MN26C as is for parts . . . . . 6.95

### MIKES, HEADSETS & MICROPHONES

**T-30 Telephone chest unit with P-1 Western Electric Transmitter** . . . . . $2.39

**HS-33 Low Impedance Headset** exc. $2.95 . . . . . new $3.45

**HS-23 Headset** . . . . . new 4.50

**CD-307** Ext. cord for HS-23-33 . . . . . Like new $.79 . . . . . new 1.29

**Throat Mike—T-30** . . . . . new .98

**Lip Mike—Navy Type** . . . . . new .98

**CW-49308 High Impedance Headset.** Complete with headband . . . Used 98¢

**TRANSMITTER** BC-375—With can tuning unit . . $39.50
**TU8, TU26** tuning unit . . . . . 2.95
**TU9, TU10** . . . . . 1.95



### APX-1 IFF EQUIPMENT

This transceiver is a treasure-house of tube sockets, coaxial fittings, resistors, condensers, microswitches, amphenol conductors and a raft of other parts. Also contains DC motor w/gear train, easily convertible to 110 VAC. Less tubes. ONLY—special . . . . . $4.95

**APX-1** complete with 28 tubes . . . . . $9.95
**APX-2** complete with 44 tubes . . . . . $14.95

### 160 METER RECEIVER POWER SUPPLY

Can be easily converted for 110 VAC, 60 cycle operation, complete with instructions, brand new, less tubes . . . . . ea. $5.95
100 KC crystal NEW . . . . . $4.95 ea.
**BL-43 BEAM ROTATOR**—Used, guaranteed . . . . . $1.95 ea. 3 for $4.95
3" **DUAL SCALE PANEL METER**—0-1 AV and 0-10MA . . . . . $1.95

**SURPRISE PACKAGE**
50 lbs. of MISCELLANEOUS ELECTRONIC EQUIPMENT—WORTH MUCH MORE THAN this low price of ONLY . . . . . $1.95

**I-70 "S" METER**—New . . . . . 89¢

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This medium power transmitter and the accompanying 7-tube very sensitive receiver are naturals for 80 or 40 meter operation (phone or CW), on either fixed stations or mobile applications. These units are used exc. and come complete with 17 tubes, hrs, microphone, 200 KC calibrating crystal and diagrams for use with up to 100 watts input to the final stage on 40 or 80 meters for either phone or CW. . . . $29.50
using vehicle or 110 Volt power supply . . .
**PE103** 6 or 12V Power Supply for above. Excellent . . . . . $6.95
**PE104** Vibrator Supply . . . . . 2.95

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**2 Meter Converter**—Easily converted to two meters—Used—Excellent, complete with conversion instructions . . . . . ea. $2.95

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**RT/34 APS 13 TRANSCEIVER**—Used as a tail warning radar on 415 MC. Containing a 30 MC IF strip, RF section and various other parts, are an excellent buy, if only for parts and IF strip. Complete with 17 tubes . . . . . Now $14.95

**BC 1032, 72 Mc RECEIVER**, less tubes, ea. $2.95
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**MOBILE HEAVY DUTY DYNAMOTOR:** 14 V. INPUT-output: 1030 VDC 200 MA. Tapped 515 V. 215 MA. use @ 6 V DC INPUT—500 V. 175 MA. While they last—DM-42-Excel. Condition . . . . $8.45

SELF-POWERED

McIntosh



C8-PM with cabinet $107.50

C8-P $99.50 without cabinet

Professional

AUDIO COMPENSATOR

AND PRE-AMPLIFIER

Now self-powered, the McIntosh C-8P is easily connected to any system to provide the most advanced in high fidelity compensation control. Abundant flexibility is possible with five bass (turnover) and five treble (roll-off) switches, an aural compensator, a rumble filter, separate wide-range bass and treble controls, and a five-program-source selector for tuner, tape recorder, microphone, and two phonograph cartridges. The McIntosh assures greatest listening pleasure from any sound source.



Small separate power supply (not shown) brings maximum convenience of installation. Rear panel (shown above) features five inputs, three outputs, equalization switch for amplitude and magnetic cartridges, variable load resistor for magnetic cartridges.

Write for Details and FREE Record Compensation Guide

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Cable: Simontrice, N. Y.


## Switching for Hi-Fi

(*Continued from page 50*)

relay $RL_1$ which, in turn, removes power from the amplifier.

It is desirable to connect the circuit exactly as shown by tracing through the FM power circuit with an ohmmeter or voltmeter. This keeps the 115-volt line voltage from appearing directly across contacts *B* to *C*, and *E* to *F* of relay $RL_1$, which can happen if the wiring polarities are not observed. The relay used here, operated satisfactorily under these adverse conditions, but good engineering practice decrees that the wiring, as shown, should be followed. The plugs and outlets are numbered or color coded so that they are always connected up the same way if the units are disconnected for any reason. The use of plugs and outlets allows the units to be connected and disconnected in a matter of minutes.

In addition to the basic circuit shown in Fig. 2, it was found that in some amplifiers a switch is included to switch the audio circuit from radio to phonograph. This switching can also be done automatically by incorporating the circuit of Fig. 3. Relay $RL_2$ is a 115-volt, 60-cycle s.p.d.t. relay connected as shown. However, this switching refinement is on the order of "gilding the lily," and although desirable is not strictly necessary.

The writer also found that his television antenna worked very satisfactorily as an FM aerial. The automatic switching for this changeover is readily accomplished with the circuit of Fig. 4. $RL_3$ is a d.p.d.t. 115-volt, 60-cycle relay. When the FM set is turned "on," relay $RL_3$ is energized which switches the television antenna

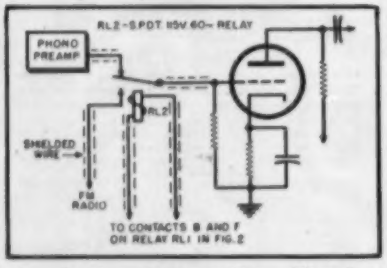
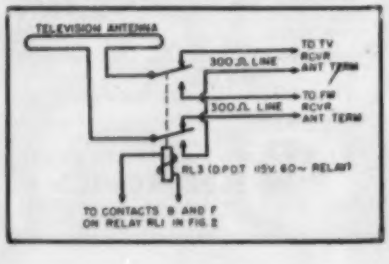



**Fig. 3. Setup for use with amplifiers incorporating a switch to transfer the audio circuit from the radio to phonograph.**

**Fig. 4. Automatic arrangement for switching a TV antenna for use with FM tuner.**





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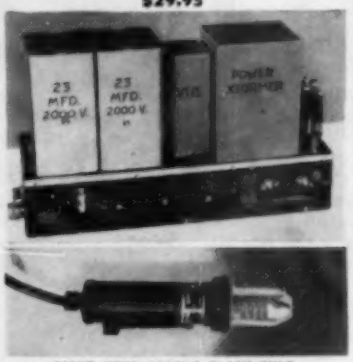
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PRACTICE CODE TAPES FOR ABOVE KEYERS @ 16MM 400 ft. reels. No. 1, No. 3, No. 5, No. 6, No. 7, No. 8, No. 9, No. 11, No. 12, No. 13, No. 14, No. 15. New in metal containers $1.25 ea.

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100 W. SEC. PHOTO-FLASH—It's Gov't surplus—it's new—it's terrific! Worth many, many times our asking price of

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LIGHT HAND ASS'Y & FLASH BULB

This synchro-flash outfit operates on 12/24 VDC source but can be easily converted to 110 VAC for a dollar or two. Ideal—for studios, outdoors, labs, and industrial photography. You will save at least $250.00 by purchasing this photo-flash. Comes complete with 200 W. sec. sylvania photo-flash bulb, A107... (Similar to Syvl. 4330 with pyrex shield.) Stroboscopic hand light ass'y, ignition coil, trigger housing, cord, and manual. New in original carton ..... $29.95

INSTRUCTION MANUAL available for a deposit of $2.00. Money will be refunded in full when returned.

200 W. sec. Syvl. bulbs ..... New $6.50 ea.

12KV rectifier tubes ..... New 1.95 ea.

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"IDEAL" MODEL S C SOLDERING PLIERS & TRANSFORMER—Thermogrip carbon pliers & connecting cable—115 VAC 60 ~. 10 amps input—OUTPUT: 3.5/4.5 V @ 90 amps Int. or 60 amps cont. duty—In metal carrying case which can be used for tool box—BRAND-NEW—WE approve. 25 lbs. ..... $19.95

BC-221 MANUAL—New, Prepaid ..... $1.25 ea.; 6 for $5.00

WESTINGHOUSE PX-14 D.C. AMMETER 2½ accuracy—1-1-10 amps—Open face portable—PM moving coil—.005 ohms—3½ meter face—4½ x 5⅛ x 1¾ —w/test leads & leather carrying case—BRAND-NEW in original mfr. package ..... $9.95

0-200 DC UA METER—4 x 4 Flange face w/2¾" rd body—960 ohms per .1 D'Arsonval movement. New ..... $6.95

0-3 R F. AMMETER—2" round. New ..... $3.25

0-300 DC UA METER—Triplett 2" round. New .. $4.95

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PE 204A VIBROPACK. 12 VDC with spare vib. New in original carton ..... $9.95

BC 306A ANTENNA LOADING TUNER. Match any antenna to your XMTR. New in original carton ..... $3.95

BC 929A. Scope indicator chassis. Includes scope tube shield and socket, plus a gold mine of parts. Build your scope on this chassis. ..... $3.95

Ceramic Condensers, assorted. Not over 20¢ ea. One Lb. $1.95; three lbs. ..... $5.00

R F AMPLIFIER SECTION FREQ. 58.3 to 95 MC Crystal Control Exciter Stages P/P R F Amplifier complete with 3 each 815 Twin Tetrode tubes, coils and tuning condensers. A Real Bargain Only. $12.95

TUBES

701-A TETRODE—Just the tube for that 1 K.W. SSB Final—Fil: 8 V @ 7.5 amps—Plate: 300 V @ 500 ma. Screen: 280 V. @ 50—Just 10 W to drive pair 1 K.W. A.M. Phone. ..... $2.95 each; 2 for $5.00

815 TETRODE TUBE $4.95 Each—Two for $9.00

200 W. sec. Sylvania flash bulbs ..... $6.50 ea.

12X3 Rectifiers $1.95 | 2051 ..... ea. $7.50

3BP1 ..... 1.95 | 9004—10 for ... 3.00

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20% WITH ORDER, BAL. INCL. POSTAGE C.O.D. MICHIGAN RESIDENTS ADD 3% SALES TAX—PRICES SUBJECT TO CHANGE WITHOUT NOTICE. ALL MERCHANDISE SUBJECT TO PRIOR SALE.

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FM $13.95

IN YOUR CAR PLUG IN TUNERS



- 88 TO 108 MC MUSIC
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AM & SHORTWAVE MODELS FOR HOME USE



12-WATT MOBILE PA AMPLIFIER

CIVIL DEFENSE, POLICE, FIRE

An extremely compact and durable 12 watt amplifier for 6 and/or 12 volts. 2 inputs, one mike, one phono. 2 output connections. 6 volt model list $89.95.

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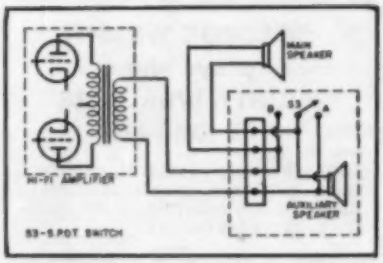



**Fig. 5. Setup for controlling a remote loudspeaker used with the high-fidelity system.**

from the TV set to the FM receiver. When the FM set is turned "off" the TV antenna is switched back to the TV receiver. This relay is mounted on the back of the TV receiver, and a piece of 300-ohm line used to connect this relay to the antenna posts of the FM receiver.

After the foregoing switching circuits were installed it was decided that one other addition was wanted. As in many homes, the man of the house has a workshop in the cellar. It seemed desirable to have an extra speaker located there, and so connected that either or both speakers could be connected to the amplifier with a simple switch circuit. This allows for maximum flexibility in a house "wired for sound." The switching circuit of Fig. 5 was designed so that the speakers could be switched without opening the voice coil circuit. This prevents the build-up of voltages that might possibly harm the output transformer of the amplifier. With the switch in the *A* position the main speaker is in the circuit and the auxiliary speaker is shorted out. When switch $S_3$ is in the *B* position the auxiliary speaker is in the circuit, and the main speaker is shorted out. When the switch is in the center or open position, both speakers are in series in the circuit. It was found that with the two speakers used in series that the audio load divided equally between them. No traces of distortion were noticed during the time the speakers were so operated. If desired, the auxiliary speaker can be provided with a shunt volume control of 0-25 ohms to adjust local volume if needed.

The system of automatic switching has been in use for some months, and has proved completely reliable, foolproof, and has more than paid for itself in the ease of operation of our high-fidelity equipment, plus the added advantage of guaranteeing automatic phono-amplifier shut-off when a stack of records is played. —30—

## HUDSON DIVISION MEET

**THE Hudson Division ARRL Convention and Amateur Radio Equipment Show will be held June 3, 4, and 5 at the Hotel Adelon, Long Beach, N. Y.**

**A varied program has been planned. Persons desiring to attend should contact Barbara F. Werner, KN2JHQ, 200 Elsie Ave., Merrick, N. Y., for reservations or further information on the program of events.** —30—


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Standard Manufacturer's
Full Year Guarantee
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0B2 .74 2A5 .49 | 6B7 .93 6F8G .69 6SK7 .39 | 12AX7 .55 35W4 .30
0B3/VR90 .90 2B6 .90 | 6B8G .39 6G6G .63 6SL7GT .49 | 12AY7 .79 35Y4 .44
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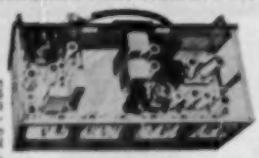
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# New Audio Equipment

### "TUNE-A-PORT" CABINET

*Standard Wood Products Corp.*, 47 W. 63rd Street, New York 23, N. Y., is now in production on a new speaker cabinet, the "Tune-A-Port".

The unit has a baffleboard adjustable from the outside—the port can be enlarged or reduced by means of two small external knobs. This feature makes certain that the speaker and enclosure resonance will be at optimum balance for maximum brilliance.

The cabinet will accommodate 12 in. or 15 in. single, coaxial, or triaxial speaker systems. It has a sound enclosure of 10,000 cubic inches and a high power-handling capacity. The cabinet is constructed of ¾ in. genuine mahogany veneer stock and has interior acoustical padding. It is currently available in mahogany, blonde, or walnut finishes and measures 36 in. high, 24 in. wide, and 17 in. deep.



### MINIATURE CARTRIDGES

*Pickering and Company Incorporated*, Oceanside, Long Island, N.Y. has developed two new miniature cartridges for the professional and the audiophile.

The 220 series is designed for use with standard 78 rpm records and is available with either diamond or sapphire styli. The 240 series is for microgroove records, both 33⅓ and 45 rpm. It is equipped with a diamond stylus.

A simple clip-type universal adapter is packaged with each cartridge to permit easy installation of the cartridge in all standard makes of changers and tone arms. The adapter can be permanently mounted in any arm by two 3-48 screws which are also provided. Once the adapter is installed the individual cartridges can be snapped into the clip.

### FM-AM TUNER

*Collins Audio Products Co., Inc.*, P. O. Box 368, Westfield, N. J., is celebrating its 10th anniversary by intro-


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ducing a new FM-AM tuner which has been tradenamed the "Custom Special."

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The tuner is housed in a gold cabinet with gray and chromium panel and ac-



cessories. It measures 5¼" high, 19" wide, and 12" deep. It may be had in light mahogany cabinets, gray hammertone cabinets, with black or gray panels at extra charge.

### "3-WAY RECORD FILTER"

The Special Products Division of *General Electric Company's* radio and television department has developed a unique high-fidelity "Three-Way Record Filter" which contains two independent filter controls and one compensator control in a single unit.

This triple filter is designed for use with any high-fidelity system having a *G-E* variable reluctance cartridge or other cartridges with the same inductance and impedance. It consists of a low-frequency cut-off filter, a record compensator, and a high-frequency cut-off filter, all housed in a plastic cabinet. The unit can be built in, if preferred, without the cabinet.

Known as the Model A1-901 record filter, full details on this new unit are available from the company in Syracuse, N. Y., or its distributors.

### PREAMP KIT

*Precise Development Corp.*, Oceanside, New York is now offering a preamplifier which is available in either kit or factory-wired form.

The Model UPA-1 is housed in a mahogany cabinet with brushed brass panel and incorporates separate controls for bass boost, volume, record



compensation, and separate treble boost and roll-off. The unit also has a main selector switch connecting to phono, microphone, radio-TV, and an auxiliary position. Four separate input jacks are mounted on the rear chassis.


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| 2A5 | .45 | 6SH7GT | .49 | 14A7 | .63 |
| 2A6 | .45 | 6SK7GT | .53 | 14AF7 | .50 |
| 2AL5 | .42 | 6SK7GT | .53 | 14B6 | .63 |
| 2AU6 | .46 | 6SL7GT | .67 | 14C5 | .79 |
| 2B7 | .74 | 6SN7GT | .50 | 14C7 | .79 |
| 2BC8 | .94 | 6SQ7 | .49 | 14E6 | .75 |
| 2BN6 | .74 | 6SQ7GT | .46 | 14E7 | .88 |
| 2C26 | .84 | 6SR7GT | .45 | 14F7 | .65 |
| 2D6 | .37 | 6SS7GT | .45 | 14F8 | .80 |
| 2LF4 | .60 | 6SZ7 | .59 | 14F7 | .50 |
| 3D6 | .39 | 6T4 | .99 | 14J7 | .50 |
| 3Q5GT | .68 | 6T8 | .98 | 14N7 | .64 |
| 3S4 | .58 | 6U5 | .70 | 14R7 | .79 |
| 3V4 | .69 | 6U6 | .59 | 14S7 | .80 |
| 4BQ7 | .98 | 6U8 | .98 | 14W7 | .80 |
| 4BZ7 | .98 | 6V3 | .59 | 14X7 | .90 |
| 5AM8 | .78 | 6V6 | .78 | 19BG6 | 1.39 |
| 5AQ5 | .78 | 6V6GT | .80 | 19T8 | .69 |
| 5AT8 | .78 | 6V8 | .80 | 19V8 | .79 |
| 5AZ4 | .50 | 6W4GT | .47 | 24A | .39 |
| 5U4 | .64 | 6W6GT | .87 | 25AV6GT | .83 |
| 5Y4 | .79 | 6X4 | .37 | 25B8GDT | .98 |
| 5U4G | .98 | 6X5GT | .37 | 25L6GT | .81 |
| 5U8 | .98 | 6X8 | .78 | 25Z5 | .66 |
| 5V4 | .71 | 6Y6G | .65 | 25Z6 | .40 |
| 5V6 | .80 | 7A4 | .49 | 27 | .55 |
| 5W4GT | .50 | 7A5 | .49 | 27 | .30 |
| 5X8 | .79 | 7A6 | .69 | 28D7 | .50 |
| 6Y3GT | .87 | 7A7 | .69 | 32L7 | .98 |
| 6Y4 | .51 | 7A8 | .68 | 35A5 | .58 |
| 6A4 | .60 | 7AD7 | .79 | 35B5 | .52 |
| 6A7 | .00 | 7AE7 | .58 | 35C5 | .51 |
| 6AB4 | .46 | 7AF7 | .79 | 35L6GT | .81 |
| 6AC5 | .60 | 7AH7 | .79 | 35W4 | .47 |
| 6AC7M | .98 | 7B4 | .44 | 35Y4 | .60 |
| 6AD7 | .89 | 7B5 | .49 | 35Z3 | .69 |
| 6AF4 | .80 | 7B6 | .49 | 35Z4GT | .47 |
| 6AG5 | .98 | 7B7 | .49 | 36 | .30 |
| 6AG7M | .98 | 7C4 | .59 | 42 | .46 |
| 6AH4 | .97 | 7C5 | .49 | 45 | .55 |
| 6AK5 | .73 | 7C6 | .59 | 45Z3 | .60 |
| 6AK6 | .79 | 7C7 | .69 | 45Z5 | .40 |
| 6AK8 | .89 | 7E5 | .50 | 46 | .60 |
| 6AL5 | .50 | 7E6 | .50 | 50A5 | .66 |
| 6AM6 | .79 | 7F7 | .99 | 50B5 | .52 |
| 6AN4 | .95 | 7F8 | .79 | 50C5 | .51 |
| 6AN8 | .79 | 7F8 | .79 | 50L6GT | .61 |
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| 6AQ6 | .49 | 7H7 | .89 | 50Y6 | .50 |
| 6AQ7 | .49 | 7J7 | .69 | 50Y7 | .50 |
| 6AR5 | .99 | 7K7 | .69 | 53 | .40 |
| 6AS5 | .80 | 7L7 | .50 | 56 | .40 |
| 6AS6 | 1.40 | 7N7 | .68 | 57 | .58 |
| 6AT6 | .98 | 7Q7 | .98 | 58 | .60 |
| 6AU4GT | .88 | 7S7 | .89 | 70L7 | .97 |
| 6AU5GT | .82 | 7V7 | .79 | 71A | .62 |
| 6AU6 | .49 | 7W7 | .79 | 75 | .40 |
| 6AV5GT | .83 | 7X6 | .54 | 76 | .40 |
| 6AV6 | .40 | 7Y4 | .70 | 77 | .67 |
| 6AX4GT | .98 | 7Z4 | .70 | 78 | .47 |
| 6BA6 | .49 | 12A6 | .50 | 80 | .43 |
| 6BA7 | .89 | 12A8 | .50 | 83V | .68 |
| 6BC5 | .84 | 12AH7GT | .61 | 84/6Z4 | .46 |
| 6BC7 | .84 | 12AU7 | .80 | 85 | .49 |
| 6BD6 | .99 | 12AL5 | .39 | 117L7 | 1.10 |
| 6BE6 | .73 | 12AV6 | .49 | 117P7 | 1.80 |
| 6BF5 | .61 | 12AT6 | .41 | 117Z6 | .60 |
| 6BF6 | .59 | 12AT7 | .78 | 807 | 1.30 |
| 6BG6GA | 1.28 | 12AU6 | .49 | 866A | 1.30 |
| 6BH6 | .63 | 12AU7 | .80 | 1274 | .30 |
| 6BJ6 | .49 | 12AV6 | .39 | | |
| 6BK5 | .80 | 12AV7 | .98 | | |
| 6BR7 | .99 | 12AX4 | .67 | | |
| 6BL7GT | .91 | 12AX7 | .83 | | |

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A separate "on-off" switch also operates the convenience outlet at the rear of the instrument.

The completed unit weighs six pounds and measures 12"x4"x4". For full details on the versions of this unit that are currently available, write the company for a data sheet.

### U-25 SPEAKER

The *Baruch-Lang* loudspeaker is now being manufactured by *Almy, Hayden & Maxwell, Inc.*, 8 Anderson Street, Marblehead, Mass. under license from *Ultrasonic Corporation* of Cambridge, Mass.

This 2-watt corner loudspeaker unit provides an acoustical coverage from 55 to 11,000 cps, according to the company. The bass response is achieved by acoustically matching the one-half cubic foot cabinet to its four specially-designed 5" PM loudspeakers.

The "Euphonic U-25" is currently being marketed through local distributors. Write the firm for literature.

### "GOLDEN GATE" TUNER

*Rauland-Borg Corporation*, 3515 W. Addison Street, Chicago 18, Illinois has released a new AM-FM tuner, the Model HF 155 "Golden Gate."

The FM section uses the Armstrong circuit and has a response ±.5% from 20 to 20,000 cps. Sensitivity is 5 μv. for 30 db of quieting. There is a tuned r.f. stage, a Foster-Seeley discriminator with dual limiters, cathode follower



with two outputs, a.f.c., drift-compensated circuits, and a built-in dipole antenna.

The AM section has a tuned r.f. stage and provides a ± 3 db response from 20 to 5000 cycles. Sensitivity is 5 μv. for 1.5 volts output. Two controls operate the entire unit. The tuner is just 4" high which permits its use on bookshelves, on an end table, or on top of any piece of furniture. The case is finished so that it can be used without a cabinet if desired. The tuner can be used up to 200 feet from the amplifier.

### TWO-SPEED RECORDER

*The Revere Camera Company* of Chicago is currently offering a new dual-speed tape recorder, the T-700-D, which includes the firm's simplified automatic keyboard control feature.

Operating at tape speeds of 3.75 and 7.5 inches per second, the T-700-D records one or two hours per 7" reel according to the tape speed. The keyboard control is electrical solenoid operated. Severe forcing or jamming combinations of keys cannot harm the mechanism, making it ideal for school children.

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tivity and permits instant location of any portion of the reel, high speed forward and rewind, and dynamic type microphone. The instrument comes complete with microphone, attachment cord, two reels (one with tape), and a carrying case.

### RCA TAPE RECORDER

A new hi-fi magnetic tape recorder-reproducer chassis which covers the audible range from 50 to above 10,000 cps and is designed for simple plug-in connection to home-assembled high-fidelity music systems is now available



from the Engineering Products Division of *Radio Corporation of America*, Camden, N. J.

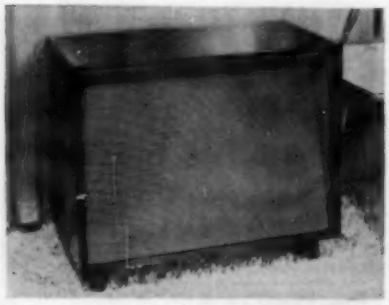
The unit, SRT-1, is electrically matched for use with all combinations of the company's intermatched hi-fi electronic components; utilizes all types of standard magnetic tapes; and is designed for half-track recording for maximum tape economy.

The recorder - reproducer chassis measures $10\frac{15}{32}$" high, 19" wide, and 11" deep. It weighs 27 pounds.

### "LARGO 12" SPEAKER

*Permoflux Corporation*, 4900 West Grand Ave., Chicago 39, Illinois has released a "big brother" to its "Largo 8," the "Largo 12." The new two-way speaker system features the company's "Super Royal" 12-inch speaker and the 32KTR "Super Tweeter."

The design of the cabinet permits the use of the cabinet base to horn-load the speaker backwave. The cabi-



net is scientifically matched, octave-by-octave, to the woofer and tweeter. According to the company, peak-free reproduction over the full range of 30 to 16,000 cps is obtained. Power handling capacity is a full 20 watts.

Over-all size of the cabinet is $23\frac{1}{8}$"


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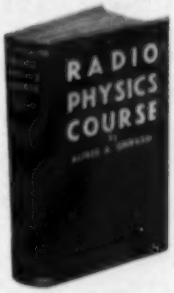
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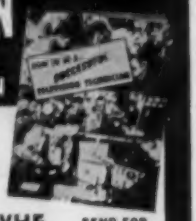
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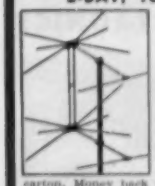
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### NEW TONE ARM

*Hi-Fidelity, Inc.*, 420 Madison Ave., New York, N.Y. has been licensed to manufacture and market the new British "B-J" tone arm in the Western Hemisphere.

The new arm has two arms of different lengths, spaced to form a link motion which keeps the head closely aligned to the ideal tangential setting, irrespective of groove radius. According to the company, the measured error amounts to less than ± 1 degree on a 12-inch record.

The cartridge shell will accept almost any standard U.S. high-fidelity cartridge.

For full details on this new arm, write to the U.S. licensee direct.

### LAFAYETTE AMPLIFIER

*Lafayette Radio*, 100 Sixth Avenue, New York 13, N.Y. is currently introducing a new power amplifier which retails in the moderate price class.

Designated as the LA-54, the amplifier is a 12-watt unit with a frequency response of 20-20,000 cycles. It includes a record equalizer with separate adjustable bass turnover and treble roll-off; sixteen different playback characteristics; phono preamplifier; input for crystal and ceramic cartridges; special recording tape take-off jack; capacitance input; and good power output at both the very-low and very-high frequencies.



For full details on this amplifier, write the company direct.

### FME TAPE RECORDER

*Federal Manufacturing and Engineering Corporation*, 211 Steuben Street, Brooklyn 5, New York is now marketing a new popular-priced, two-speed, dual-track tape recorder, the Model 37C.

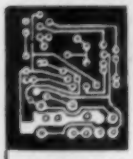
A two-belt system eliminates the possibility of wear and squeal, according to the company. The recorder is housed in a two-tone gray luggage-type carrying case while the controls are streamlined and modern looking.

### CRYSTAL CARTRIDGE

*The Astatic Corporation* of Conneaut, Ohio has introduced another high-compliance crystal phonograph cartridge, the Model 28.

The company claims that this cartridge provides greater clarity and richness of tone as well as an absence of

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needle talk and surface noise due to its high compliance and the resultant improvement in tracking ability.

Output is 3.5 volts and the cartridge is said to be suitable for all-groove use. For full details and price on the Model 28, write the company direct.

### NEW NATIONAL ITEMS

*National Company Inc.*, 61 Sherman St., Malden 48, Mass. has added five new items to its "Horizon" line of audio equipment.

Among the units are four new hi-fi speaker systems including the "Cate-



noid" four-way corner horn with crossover network; the "Copley," a three-way corner system; the "Wellesley," a deluxe vesion of the "Copley"; and the "Fantasia," an end table type with dual speakers and wrought iron legs, which is shown in the photo.

All of the cabinets are offered in blonde, mahogany, and walnut, both hand-rubbed and Formica finished.

All of these new items are currently on display at the firm's authorized distributors. —30—

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| 62, 63 | Sherwood Electronic Laboratories |

### ADDENDUM

**Some of our readers have written us that they are having difficulty in locating the 20/20/20 μμfd. variable capacitor specified in the parts list ($C_1$, $C_2$, $C_3$) accompanying the article "Midget FM Tuner" (December 1954 issue). Three of the Millen 20015 "ultra-midget" capacitors may be ganged and will fit the allotted space on the chassis.**


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| 1B3GT | .60 | 6BK5 | .69 | 6SJ7 | .50 | 12AT6 | .41 | 14H7 | .59 |
| 1D8GT | .77 | 6BK7 | .96 | 6SK7 | .49 | 12AT7 | .73 | 14N7 | .69 |
| 1G6GT | .54 | 6BL7GT | .89 | 6SL7GT | .59 | 12AU6 | .45 | 14Y4 | .69 |
| 1H5GT | .43 | 6BN6 | .79 | 6SN7GT | .59 | 12AU7 | .59 | 19BG6G | 1.35 |
| 1L4 | .49 | 6BQ6GT | .95 | 6SQ7 | .45 | 12AV6 | .44 | 19T8 | .79 |
| 1LA4 | .59 | 6BQ7A | .92 | 6SR7 | .45 | 12AV7 | .72 | 25AV5GT | .84 |
| 1LA6 | .79 | 6BZ7 | .92 | 6SS7 | .60 | 12AX4GT | .88 | 25BQ6GT | .89 |
| 1LC5 | .59 | 6C4 | .41 | 6ST7 | .49 | 12AX7 | .63 | 25L6GT | .49 |
| 1LD5 | .52 | 6C5 | .39 | 6T4 | .95 | 12AY7 | .89 | 25Y5 | .85 |
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| 1LN5 | .57 | 6C8G | .85 | 6T8 | .79 | 12BA7 | .59 | 25Z6GT | .48 |
| 1P5GT | .56 | 6CB6 | .57 | 6U7G | .45 | 12BD6 | .49 | 26 | .44 |
| 1Q5GT | .57 | 6CD6G | 1.49 | 6U8 | .79 | 12BE6 | .49 | 27 | .38 |
| 1R5 | .54 | 6CF6 | .64 | 6V6GT | .47 | 12BH7 | .65 | 32L7GT | .99 |
| 1S4 | .58 | 6CS6 | .51 | 6W4GT | .45 | 12BY7 | .69 | 35B5 | .49 |
| 1S5 | .45 | 6D6 | .69 | 6W6GT | .56 | 12BZ7 | .65 | 35C5 | .48 |
| 1T4 | .55 | 6E5 | .48 | 6X4 | .39 | 12C8 | .34 | 35L6GT | .49 |
| 1U4 | .53 | 6F5 | .39 | 6X5GT | .37 | 12F5GT | .35 | 35W4 | .43 |
| 1U5 | .48 | 6F6 | .45 | 6X8 | .79 | 12H6 | .45 | 35Z3 | .43 |
| 1V | .69 | 6F8G | .99 | 7A4 | .54 | 12J5GT | .45 | 35Z5GT | .47 |
| 1X2A | .69 | 6G6G | .65 | 7A5 | .59 | 12J7GT | .58 | 41 | .41 |
| 2A6 | .49 | 6H6 | .49 | 7A6 | .69 | 12K8 | .58 | 43 | .55 |
| 2A7 | .64 | 6J5GT | .40 | 7A7 | .69 | 12Q7GT | .59 | 45Z3 | .42 |
| 2X2 | .39 | 6J6 | .59 | 7A8 | .59 | 12SA7GT | .64 | 46 | .49 |
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| 3B7 | .39 | 6S4 | .49 | 7E5/1201 | .59 | 12SL7GT | .57 | 57 | .55 |
| 3BC5 | .55 | 6S7G | .59 | 7H7 | .59 | 12SN7GT | .58 | 58 | .58 |
| 3BN6 | .75 | 6SA7 | .54 | 7J7 | .75 | 12SQ7GT | .56 | 70L7GT | 1.00 |
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| 3D6 | .39 | 6SC7 | .79 | 7R7 | .65 | 12Z3 | .39 | 75 | .49 |
| 3LF4 | .79 | 6SF5 | .45 | 7V7 | .91 | 14A4 | .69 | 76 | .43 |
| 3Q4 | .55 | | | | | | | 77 | .55 |
| | | | | | | | | 78 | .45 |

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| 85 | .59 |
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| 117Z3 | .38 |
| 807 | 1.39 |
| 2051 | .95 |
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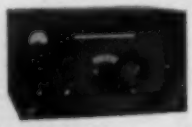


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# INDEX OF *Advertisers*

MAY 1955

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.


| ADVERTISER | PAGE |
|---|---|
| Aaron Electronic Sales | 152 |
| Acro Products Company | 161 |
| Aermotor Company | 138 |
| Airex Radio Corp. | 129 |
| Allied Radio Corp. | 9 |
| Altec Lansing Corporation | 16 |
| American Microphone Co. | 144 |
| American Phenolic Corporation | 126 |
| American Television & Radio Co. | 106 |
| Arkay Radio Kits | 119 |
| Arrow Sales, Inc. | 154 |
| Ashe Radio Co., Walter | 20 |
| Associated Industries | 158 |
| Audel Publishers | 153 |
| Audio League, The | 156 |
| B & K Mfg. Co. | 128 |
| Baltimore Technical Institute | 132 |
| Barry Electronics Corp. | 155 |
| Belden Manufacturing Company | 71 |
| Bellford-Matic, Inc. | 128 |
| Bell Telephone Laboratories | 12 |
| British Industries Corp. | 76 |
| CBS-Hytron | 23 |
| Cabinart | 95 |
| Candler System Co. | 161 |
| Cannon Electric Company | 17 |
| Capcon, Inc. | 154 |
| Capitol Radio Engineering Institute | 69 |
| Central Electronics, Inc. | 78 |
| Centralab | 97 |
| Century Books | 146 |
| Channel Master Corp. | 28, 29 |
| Chicago Standard Transformer Corporation | 135 |
| Cleveland Institute of Radio Electronics | 105 |
| Collins Audio Products Co., Inc. | 124 |
| Columbia Electronics Corp. | 153 |
| Columbia Electronics Sales | 132 |
| Commissioned Electronics Co. | 128 |
| Concord Radio | 135 |
| Coyne Electrical School | 76, 145 |
| Delco Radio | 31 |
| DeVry Technical Institute | 5 |
| Douglas Instrument Laboratory | 118 |
| Duro Electronics Co. | 142 |
| Dynamu Magnetronics Corporation | 26 |
| Eby Sales Co. of N. Y. | 156 |
| Editors & Engineers, Ltd. | 146 |
| Electronic Chemical Corp. | 137 |
| Electronic Instrument Co., Inc. (EICO) | 33, 34, 129, 138, 157 |
| Electron Tube Wholesalers, Inc. | 159 |
| Electro-Voice | 8 |
| Erie Resistor Corporation | 147 |
| Espey Manufacturing Co., Inc. | 22 |
| Fair Radio Sales | 119 |
| Finney Company | 14, 15 |
| Fisher Radio Corp. | 98, 99, 100, 101 |
| G & G Radio Supply Co. | 121 |
| G. L. Electronics, Inc. | 112 |
| General Cement Mfg. Co. | 30 |
| Geneva Electronics of New York | 139 |
| Goldstar Co., The | 149 |
| Goodheart, R. E. | 112, 142 |
| Grantham School of Electronics | 156 |
| Greenlee Tool Co. | 115 |
| Harjo Sales Co. | 106 |
| Harvey Radio Co., Inc. | 160 |
| Heath Company | 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94 |
| Henry Radio Stores | 157 |
| Hickok Electrical Instrument Co. | 134 |
| High Fidelity Recordings, Inc. | 154 |
| Hughes Research and Development Laboratories | 111, 116 |
| Hycon Manufacturing Co. | 123 |
| Indiana Technical College | 146 |
| Instructograph Company | 140 |
| International Radio & Electronics Corp. | 155 |
| International Resistance Company | 19 |
| J. E. S. Co. | 150 |
| J. J. Glass Electronics Co. | 156 |
| Jackson Electrical Instrument Co. | 158 |
| Jazz-Tone Society, Inc. | 147 |
| Jerrold Electronics Corporation | 80 |
| Jersey Specialty Co. | 125 |
| Johnson Company, E. F. | 72 |
| Jones & Laughlin Steel Corporation | 131 |
| Karlson Associates, Inc. | 141 |
| Kester Solder Company | 114 |
| Kuehne Mfg. Co. | 24 |
| Kuhn Electronic Products | 132 |
| Lafayette Radio | 32 |
| Lampkin Laboratories | 96 |
| Lektron Specialties | 140 |
| Leotone Radio Corp. | 153 |
| Liberty Electronics, Inc. | 114 |
| Lytron Distributing Co. | 143 |
| McGee Radio Company | 108, 109 |
| McGraw-Hill Book Co., Inc. | 130 |
| McIntosh Engineering Laboratory | 152 |
| M. R. Company | 158 |
| Mallory & Co., Inc., P. R. | 75, 4th Cover |
| Marantz, S. B. | 118 |
| Mattison Television & Radio Corp. | 136 |
| Milwaukee School of Engineering | 136 |
| Mosley Electronics, Inc. | 125 |
| Moss Electronic Distributing Co., Inc. | 102, 103 |
| Music At Home | 158 |
| National Electronics of Cleveland | 158 |
| National Radio Institute | 3, 7 |
| National Schools | 25 |
| Newark Electric Company | 76 |
| Newcomb | 132 |
| Nichols Wire & Aluminum Co. | 140 |
| Norman Electronics Co. | 136 |
| Nucleonics Corp. of America | 122 |
| Orradio Industries, Inc. | 116 |
| Peak Electronics Co. | 134 |
| Perma Power Company | 148 |
| Permoflux Corp. | 18 |
| Phaostron Corp. | 117 |
| Philco Corporation | 13 |
| Pickering & Company, Incorporated | 10 |
| Platt Electronics Corp. | 142 |
| Popular Photography | 150 |
| Progressive "Edu-Kits", Inc. | 125 |
| R.C.A. Institutes, Inc. | 21, 119, 133 |
| R.C.A. Service Company, Inc. | 79 |
| RW Electronics | 151 |
| Radiart Corp., The | 6 |
| Radio Corporation of America | 139 |
| Radio Craftsmen, Inc. | 114 |
| Radiumodels | 119 |
| Radio Products Co. | 161 |
| Radio-Television Training Association | 11 |
| Rad-Tel Tube Co. | 156 |
| Raytheon Manufacturing Company | 2nd Cover |
| Raytronics | 73 |
| Record Changer-Wire & Tape Parts Co. | 130 |
| Receton Corp. | 149 |
| Regency, Division I.D.E.A., Inc. | 130 |
| Reiter | 142 |
| Rek-O-Kut Company | 138 |
| Rider, John F., Publisher | 159 |
| Rinehart & Co., Inc. | 72, 122, 157 |
| Rock Bar Corporation | 150 |
| Sams & Co., Inc., Howard W. | 81 |
| Sam's Surplus | 127 |
| Sarkes-Tarzian | 113 |
| Scientific Equipment Distributors | 122 |
| Service Instruments Co. | 148 |
| Sherwood Electronic Labs. | 120 |
| Sonotone Corporation | 107 |
| Sound Apparatus Company | 148 |
| Stan Burn Radio & Electronics Co. | 118 |
| Stanley Electronics Corp. | 96 |
| Stephens Manufacturing Corp. | 137 |
| Steve-El Electronics Corp. | 149 |
| Stevens Walden, Inc. | 145 |
| Supreme Publications | 115 |
| Sylvania Electric Products, Inc. | 27 |
| "TAB" | 162 |
| Tech Master Products, Inc. | 146 |
| Tele-diagnosis Co. | 158 |
| Teltron Electric Company | 143 |
| Tentenna, Inc. | 72 |
| Terado Company | 110 |
| Transvision, Inc. | 112, 155 |
| Triad Transformer Corp. | 82 |
| Triplett Electrical Instrument Co. | 3rd Cover |
| Tri-State College | 150 |
| Tung-Sol Electric, Inc. | 104 |
| Ungar Electric Tools, Inc. | 145 |
| United Radio Co. | 156 |
| University Loudspeakers, Inc. | 104 |
| Uranium Prospectors Equipment | 146 |
| U. S. Crystals, Inc. | 77, 120 |
| Valparaiso Technical Institute | 143 |
| Vidaire Electronics Mfg. Corp. | 143 |
| Western Television Institute | 158 |
| Wholesale Radio Parts Co., Inc. | 130 |
| World Radio Laboratories | 141 |
| Xcelite, Incorporated | 70 |
| Zinge Products | 118 |

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Prices slightly higher in the West

## ACRO PRODUCTS CO.

**369 SHURS LANE, PHILADELPHIA 28, PA.**






## TV TUNER REPAIRS

**48-HOUR SERVICE**

Defective tuners rebuilt to factory standards. New tuner guarantee. Ship prepaid.

**RADIO PRODUCTS CO.**

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## NEW HIGH CURRENT POWER SUPPLIES—ONE YEAR GTD

Variable 0-28 VDC, Completely Built, Full Wave Selenium Rectifier, Transformer, Variac, Volt & Amp Meters, Switch, Terminals & Fuse, Housed in Hvy Duty Steel Cabinets.

Std 115V/60cy Input. 110 & 220V† and 3 phase to order.

Steel Cabinets. Std 115V/60cy Input. 110 & 220 V† and 3 phase to order.

| Stk No. | Cont. Rating | W/Meters |
|---|---|---|
| T28V5A | 0-28 WVDC at 5 Amp | $ 42 |
| T28V5ACC | 5 Amp (1% Ripple) | $ 49 |
| T28V5ACCC | 0-28 VDC at 5 Amp (0.01% Ripple) | $109 |
| T28V12A | 0-28 VDC at 12 Amp | $108 |
| T28V12ACC | 12 Amp (1% Ripple) | $129 |
| T28V12ACCC | 0-28 VDC at 12 Amp (0.01% Ripple) | $199 |
| T28V24A† | 0-28 VDC at 24 Amp | $135 |
| T28V24ACC† | 24 Amp (1% Ripple) | $195 |
| T28V24ACCC | 0-28 VDC at 24 Amp (0.01% Ripple) | $279 |
| T28V60A† | 0-28 VDC at 60 Amp | $350 |
| T28V60ACC† | 60 Amp (1% Ripple) | $450 |
| T28V100A | 0-28 VDC at 100 Amp | $495 |
| T28V100ACC† | 100 Amp (1% Ripple) | $650 |

Variable 75 to 135 VDC, Completely built. Ready to use. Selenium Bridge Rectifier, Filter, 4" Rectangular Volt & Ammeter, Overload Cut-Out and Components in stove enamelled, Dsgnd for continuous service. Specify for 115 or 230 VAC/1 phase, 60 cy Input.

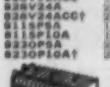
| Stk No. | Cont. Rating | W/Meters |
|---|---|---|
| T120V5AC | 75 to 135 VVDC at 5 Amp | $169.50 |
| T120V5ACC | 75 to 135 VDC at 5 Amp (1% Ripple) | $217.50 |
| T120V10AC | 75 to 135 VDC at 10 Amp | $215.50 |
| T120V10ACC | 75 to 135 VDC at 10 Amp (1% Ripple) | $269.50 |

## NEW! LOW PRICED HI CURRENT BASIC SUPPLIES

Consisting of Transformer & Full Wave Bridge Rectifier mtd & wired with no frills. Ready to deliver constant DC power. Input 115 VAC, others 115 & 230 VAC† and 3 phase.



| Stk No. | Cont. Rating | Basic |
|---|---|---|
| B28V5A | 28 WVDC at 5 Amp | $38.00 |
| B28V5ACC | 5 Amp (1% Ripple) | 49.00 |
| B28V12A | 28 VDC at 12 Amp | 78.00 |
| B28V12ACC | 12 Amp (1% Ripple) | 109.00 |
| B28V24A | 28 VDC at 24 Amp | 110.00 |
| B28V24ACC† | 24 Amp (1% Ripple) | 159.00 |
| B115P5A | 115 WVDC at 5 Amp | 89.95 |
| B115P10A | 115 VDC at 10 Amp | 99.50 |
| B115P20A | 115 WVDC at 20 Amp | 187.50 |
| B230P10A† | 230 VDC at 10 Amp | 182.75 |



## NEW "TABTRON" SELENIUM BRIDGE RECTIFIERS DATED & YR GTD

We mfg. Power Rectifiers to your specs. From 1 Amp up to and above 1000 Amps. Following List, Full Wave Bridge.

| Cur. Cont. | 18/14 Volts | 36/28 Volts | 54/42 Volts | 130/100 Volts |
|---|---|---|---|---|
| 1AMP | $1.30 | $2.35 | $3.30 | $ 8.50 |
| 2AMP | 2.00 | 3.75 | 5.25 | 10.50 |
| 3AMP | 2.60 | 4.80 | 7.00 | 12.00 |
| 4AMP | 3.00 | 5.75 | 8.00 | 13.00 |
| 6AMP | 4.00 | 7.75 | 12.00 | 32.00 |
| 10AMP | 6.50 | 12.85 | 19.50 | 41.90 |
| 15AMP | 9.00 | 16.75 | 23.50 | 49.75 |
| 20AMP | 12.00 | 22.00 | 32.00 | 78.50 |
| 34AMP | 16.00 | 31.00 | 44.50 | 99.00 |
| 50AMP | 19.90 | 37.50 | 56.50 | 110.00 |
| 75AMP | 26.00 | 50.00 | 69.00 | 138.00 |
| 90AMP | 31.00 | 61.50 | Q | 175.00 |

## RECTIFIER & TRANSFORMER COMBO

115V/60 Cy Input

Up to 14VDC at 12 Amps.....$19.00
Up to 28VDC at 12 Amps.....$29.00
Up to 28VDC at 24 Amps.....$39.00
Up to 28VDC at 12 Amps*.....$37.00
Up to 28VDC at 24 Amps*.....$47.00
Up to 28VDC at 100 Amps*.....$199.00
*Transformer has 115 & 230 V Primary.

## HEAVY DUTY BATTERY "FAST" CHARGER RECTIFIER



13-0-13V (CT) 100 Amp Fan Cooled or 34 Amp Air Cooled. Rapid "fast" 6V Booster Charger. Model CR1G $110.; 5/$27. 14-0-14V (CT) Fan Cooled. For 12V/60A and 6V/100A Booster Charger. Model CR3G $11; 3/$30

**Convert Your 6 V "Fast" Chgr to 12V/50A As Well As 6V/100A Use** Details & Rectifier.....$23.00 ea; 3/$60

6CT-2/8A 2A Battery "TRICKLE" Chgr.....$2.98
6CT-6/15-1B/5A 5A Battery "TRICKLE" Chgr.....$14.95

## NOW POWER YOUR GOV'T SURPLUS

Rec'rs & Transmitters From the Hot Power Pack or Dynamotor. From 115 or 230 VAC.

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|---|---|---|
| 628V/5A | for ARC5, BC312, 342, 348 | $38 |
| 628V/24A | for BC 610 or BC375 | $110 |
| 612V/50A | for BC191 | $110 |
| 628V/100A | for ART13 | $305 |

## NEW RECTIFIER XFMRS

Primary 115V 60 Cyc
Sec 18-18-0-0-18-18V

| | |
|---|---|
| 5 Amp † | $8.00; 2/$15.75 |
| 12 Amp † | $16.95; 2/$32.95 |
| 24 Amp† | $32.50; 2/$62.95 |
| 50 Amp* | $59.00; 2/$112 |
| 100 Amp* | $108.00; 2/$210 |

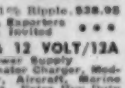
18 Volt only 5 Amps.....$1.98
†Dual Primary 115 & 230 Volt.
*Use 2X on 18-18-0-0. Can be in Series or Parallel.

## NEW RECTIFIER CHOKES

CH1/1AMP/0.1HY/1.4Ω/2# .....$2.95
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CH07/9AMP/.07HY/.9Ω/10# .....$7.95
CH01/12AMP/.01HY/.1Ω/12# .....$14.95
CH004/24A/.004HY/.025Ω/20# .....$30.00

## VARIABLE DC POWER SUPPLY

Full Wave Rectification, 6000 Mfd filter condenser, fused. 6.3V or 12.6V at 5 amp. operates 115V/60cy.



Model 2DCP.....$12.00
As above except 5 Amp Model 5DCP.....$20.00
Model 5DCF ACC/5amp/1% Ripple..$38.95

★★★ Mfrs, Dealers & Exporters Your Inquiries Invited ★★★

## NEW VARIABLE 6 & 12 VOLT/12A



DC Power Supply Battery Eliminator Charger, Model of RR, Plater, Aircraft, Marine or any DC Req. Extra Hvy Duty Selenium Rectifier. 2 Meters V & A. Dsgnd for Cont. Service & up to 20 Amps Intermittent overload. Model V612V12AC.....$20.00

# "TAB" THAT'S A BUY

## SENSATIONAL OFFER! !

**FT243 CRYSTALS***

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| 3525 | 6778† | 6335 |
| 1040 | 5230 | 8333.3 |

Asst'd 10 or more .....ea.
Asst'd 5 or more .....89¢
Sold Singly ea. .....$1.00
3775 $6230
4150 $485
Assorted 10 or more .....ea.
Assorted 5 or more .....ea. 89¢
Sold Singly .....ea. 45¢
*Listed in Kilocycles.

59¢



26¢

## 230 TO 115V AUTOFORMERS



For 230-240V/50-60 cy in, 115V/50 or 60 cy Step-up. W/ Cord, Plug & Receptacle.

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| TPA050/50W | $2.95 |
| TPA100/100W | $3.95 |
| TPA100/100W | $4.00 |
| TPA200/200W | $5.75 |
| TPA250/250W | $6.75 |
| TPA300/300W | $7.25 |
| TPA500/500W | $8.25 |
| TPA750/750W | $11.75 |
| Model TPA1000/1000W/1 KW | $14.95 |
| Model TPA2000/2000W/2 KW | $25.95 |

$100 Order Take 10% Disc.

## IT'S "TAB" FOR YOUR TOOLS



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20G/ ¼" Elec. Speed Drill w/Jacobs chuck, 2400 RPM/115VAC Quiet.....$14.25
40G/ ½" Elec. Speed Drill w/keyed chuck. 24 Speeds.....$29.95
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Cummins 6½" Maxsaw (90° + 45° cut).....$39.95

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Model V107—2½" jaw width, max. open 2¼", Straight Jaw, Full Acme Thread spindle & malleable iron casting. Ideal for Home, Radio & Shop.....$3.00
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Time Saver Master Kit 17-Pc., includes every nut & screwdriver used in Radio, Refrigerator & TV repair. Kit contains hvy duty handle, ratchet & set-tension drive, (2) Phillips & (3) screwdriver long blades, (8) nut drivers ¼" to 9/16". Deeply recessed for those loose fitting screws. High Quality Tempered Steel. Case. GTD to SATISFY. Special.....$8.98 ea.
3 for $17

## NEW CAP CHECK! Precision Capacitor Checker Checks Condensers While in the Circuit



! SAVES TIME & MONEY !

Note these "PLUS" Features—Checks condensers in circuit. No need for unsoldering. Direct readings in microfarads. Large scale to read .01¼" micrometer. Built in Volt. Ohm & Capacity Scales. Instantly gives condition of capacitor without removing from circuit. Engineered for Servicemen, Engineer & Factory. (Postpaid U.S.A.).....$44.00

**4MFD/1200VDC 10MFD/600VDC (or asst'd)**

LOTS OF 12.....$1.50
Sold Singly.....each $1.79

## • BUYS OF THE MONTH •



Sound Pwr Headset, Chest & Throat Mike U.S.N.....$18.95
Clamp Lamp, Adj.—w/Bulb & Reflector.....$1.89; 7/$10
Hook Up Wire, Asst'd Colors, 100 ft p/roll; 500 ft. ..6/$10
Planetary Drive 5:1 & 1 to 1.....$2.49
Blower Turbine Type, 50CFM/28VACDC Dia. 3" Self Lubr. Bearings, Rugged.....$4.98
W/115 VAC Xfmr.....98.98; Lots of 3/$18
Williamson Amplifier Kit, ultra linear 20 watts freq. 8-100 Kc/10 Kc/10 W (±) 1 db. Model TAB 20, $47.50; wired to sp.....$95
Std Vinyl Elec. Tape, HiV 7 mil 66 ft. 8/$2
Min. Bridge Rect. Rated 115VAC/125mA, 1/$1

**1st QUALITY • NO ELECTRICAL OR MECHANICAL REJECTS • HICKOCK MU TESTED • FULL RETMA WARRANTY**

# TUBES

**Tube Orders Over $20, with Full Payment, Prepaid to You in U. S. A.**

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TO GET THIS DEAL, MENTION SRNS WHEN ORDERING

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 0A2 | .74 | 1LA6 | 1.01 | 2K33A | 165.00 | 6AB7 | .76 | 6Q6 | .92 | FG17 | 3.01 | 801A | .45 | 5T5 | 2.05 |
| 0A3/VR4 | 4.15 | 1LB4 | .76 | 2K35 | 160.00 | 6AC5 | 1.49 | 6J4 | 4.50 | FG81A | 1.98 | 807 | 1.79 | 5U4 | 2.70 |
| 0A4 | .98 | 1LN5 | .78 | 2K45 | 76.00 | 6AC7 | .58 | 6J6 | .46 | 24A | .92 | 807 | 1.19 | 5V4 | .74 |
| 0B2 | .74 | 1N5 | .78 | 2V3 | 2.90 | 6AD7 | 1.47 | 6J6 | .66 | 25B6G | 1.30 | 808 | 2.62 | 5Y3 | 5.00 |
| 0B2/VR4 | 4.15 | 1P21 | 2.50 | 2V3A | 3.50 | 6AE5 | 1.38 | 6K6 | .66 | 25L6 | .75 | 811A | 3.98 | 5Y4 | .81 |
| 0C3 | .98 | 1P21 | 32.00 | 3A4 | .48 | 6AG5 | .71 | 6L6 | .98 | 25W4 | .75 | 812A | 3.88 | 6005 | 2.80 |
| 0D3 | .78 | 1P28 | 9.50 | 3A5 | .48 | 6AH4 | .87 | 6S4 | .99 | 25Z5 | .75 | 814 | 2.48 | 6080 | 5.98 |
| 0G4 | 1.20 | 1P29 | 10.50 | 3B22 | 1.49 | 6AK5 | .42 | 6SA7 | .67 | 25Z6 | .75 | 829B | 9.50 | 6146 | 3.98 |
| 1A3 | .98 | 1P30 | 2.40 | 3B24 | 2.70 | 6AL5 | 1.77 | 6SC7 | .74 | 35L6 | .69 | 832A | 49.19 | 6161 | 1.58 |
| 1A5 | .78 | 1P30 | 2.09 | 3B7 | .80 | 6AK5 | .42 | 6SF5 | .68 | 35Z4 | .64 | 866A | .48 | 6176 | 6.45 |
| 1A7 | .98 | 1P35 | 10.50 | 3B22 | 1.49 | 6AL5 | 1.22 | 6SH7 | .68 | 35Z5 | .67 | 872A | 1.29 | 6201 | 2.49 |
| 1AB5 | .48 | 1Q5 | 1.10 | 3B24 | 2.50 | 6AL7 | 1.22 | 6SJ7 | .69 | 42Z5 | .69 | 872A | 1.29 | 6241 | 6.45 |
| 1AD4 | 3.95 | 1Q5G | 69.00 | 3B26 | 3.50 | 6AM8 | 1.27 | 6SK7 | .64 | 80A3 | .72 | 872A | .62 | 6201 | 2.99 |
| 1AE4 | 1.07 | 1R5 | .68 | 3C24 | 3.98 | 6AN5 | 1.49 | 6SL7 | .84 | 80G6 | .84 | 9003 | 1.04 | 6202 | 24.95 |
| 1AG4 | 1.07 | 1R8 | .68 | 3C25 | 85.00 | 6AQ5 | .52 | 6SQ7 | .66 | 117Z3 | 5.49 | 914A | 93.46 | 6203 | 24.95 |
| 1AH4 | 1.07 | 1S4 | .68 | 3C24 | 3.98 | 6AQ6 | 1.24 | 6T4 | 1.36 | 717A | .74 | 927 | 1.26 | 6005 | 4.07 |
| 1B3 | .78 | 1S5 | .68 | 3C45 | 9.98 | 6AQ7 | 1.24 | 6V6GT | .58 | 717B | 1.74 | 927 | 1.26 | 6012 | 4.91 |
| 1B3 | .78 | 1T4 | .68 | 3D6 | .48 | 6AR5 | .79 | 6W4 | .58 | 1OOTH | 7.98 | 956 | .81 | 6013 | 4.91 |
| 1B5 | .48 | 1T5 | .98 | 3D21A | 7.98 | 6AR6 | 2.74 | 7A4 | .78 | 1176NG | 1.07 | 973 | 16.98 | 9001 | .88 |
| 1B22 | 1.49 | 1U4 | .68 | 3E29 | 16.98 | 6AT6 | 1.24 | 7AG7 | .78 | 1203GA | 1.07 | 1000 | 1.98 | 9002 | .88 |
| 1B23 | 4.11 | 1U5 | .64 | 3E29 | 6.00 | 6AT6 | .42 | 7B6 | .72 | 1619 | 27.99 | 1092 | 2.98 | 9003 | .98 |
| 1B26 | 1.79 | 1V2 | .68 | 3J31 | 65.50 | 6AU4 | .67 | 7C5 | .74 | 2D21 | .98 | 1612 | 1.98 | 9004 | .98 |
| 1B26A | 1.79 | 1V2A | .68 | 3K22 | 278.00 | 6AU6 | .49 | 7C6 | 60.87 | 2050TH | 35.00 | 1613 | 1.98 | 9006 | .98 |
| 1B27A | 8.76 | 2A3 | 1.27 | 3LF4 | 1.47 | 6AV6 | .48 | 7E6 | .54 | 2B0TL | 10.11 | 1625 | .44 | | |
| 1B3B | 38.50 | 2A5 | 1.49 | 3Q4 | .48 | 6AW8 | 1.09 | 7F7 | .82 | 3O4TH | 10.98 | 1633 | .98 | | |
| 1B40 | 2.98 | 2B21 | .75 | 3Q5 | .68 | 6AX4 | 1.24 | 7J7 | 1.06 | 3O5TL | 10.98 | 1635 | .98 | | |
| 1B41 | 48.00 | 2C26A | .49 | 3S4 | 1.12 | 6B4 | 1.12 | 7Q7 | 1.01 | 304A | 1.98 | 2050 | .98 | | |
| 1B46 | 1.86 | 2C34 | .40 | 3V4 | .79 | 6B8 | 1.18 | 7V7 | 1.06 | WL417A | 8.48 | 2051 | .68 | | |
| 1B47 | 2.98 | 2C36 | 25.00 | 4B32 | 10.98 | 6BA6 | .44 | 7Y4 | .78 | 450TH | 78.98 | 5516 | 4.51 | | |
| 1B63A | 42.50 | 2C39A | 16.50 | 4C35 | 10.98 | 6BC5 | .74 | 8AC7 | 1.19 | 502AX | 2.98 | 5545 | 34.50 | | |
| 1B68 | 16.99 | 2C40 | 7.22 | 4C35 | 8.98 | 6BC8 | .76 | 12AC7 | 1.19 | 503AX | 2.98 | 5545A | 1.98 | | |
| 1B90 | 4.50 | 2C43 | 11.50 | 4C35 | 15.00 | 6BD6 | .74 | 12AL5 | .84 | 503BX | 2.50 | 5636 | 9.99 | | |
| 1B90 | 4.50 | 2C53 | 11.50 | 4D21 | 10.98 | 6BE6 | .74 | 12AT7 | 1.24 | 503CX | 2.50 | 5638 | 9.99 | | |
| 1C5 | .89 | 2D21 | .80 | 4E27 | 12.98 | 6BF6 | .76 | 12AU7 | .98 | 538DX | .98 | 5641 | 6.50 | | |
| 1C7 | .98 | 2E22 | 1.98 | 4J32 | 60.00 | 6BG6G | 1.58 | 12AV7 | .98 | 541DX | 2.50 | 5642 | 6.50 | | |
| 1C21 | 3.00 | 2E24 | 2.48 | 5AN8 | 1.09 | 6BH6 | 1.08 | 12AX7 | .89 | 544DX | 2.50 | 5643 | 2.06 | | |
| 1C24 | .69 | 2E30 | 3.78 | 5AW4 | 1.37 | 6BL7 | 1.18 | 12BA6 | .49 | 544DX | 2.50 | 5670 | 2.24 | | |
| 1D5 | .69 | 2E30 | 3.78 | 5BK7 | 1.37 | 6BN7 | 1.24 | 12BE6 | .83 | 571AX | 4.48 | 5675 | 1.58 | | |
| 1D21 | 3.49 | 2E42 | 1.49 | 5BZ4 | .64 | 6BQ6 | .87 | 12BH7 | 1.08 | 572B | 24.98 | 5676 | 1.58 | | |
| 1E5 | .69 | 2J21A | 6.81 | 5C22 | 29.97 | 6BZ7 | 1.27 | 12BZ7 | 1.08 | WL676 | 24.98 | 5678 | 1.06 | | |
| 1E7 | .69 | 2J26 | 6.81 | 5C22 | 8.98 | 6C4 | 1.23 | 12J5 | .48 | 701A | 1.98 | 5682 | 6.40 | | |
| 1F4 | .49 | 2J30 | 60.50 | 5J29 | 10.00 | 6C7 | 3.50 | 12K8 | .70 | 703A | 1.98 | 5692 | 6.40 | | |
| 1F4 | .49 | 2J32 | 15.00 | 5R4GY | .84 | 6C21 | 1.27 | 12L6 | .70 | 705A | .98 | 5697 | 3.70 | | |
| 1F5 | .69 | 2J32 | 15.00 | 5T4 | .64 | 6CB6 | 1.23 | 12SA7 | .64 | 710A | 1.58 | 5722 | 3.94 | | |
| 1H4 | .49 | 2J42 | 99.50 | 5U4G | .64 | 6CD6 | 1.58 | 12SC7 | .91 | 717A | .45 | 5725 | 3.94 | | |
| 1H5 | .78 | 2J55 | 48.00 | 5V4 | .89 | 6CF6 | 1.25 | 12SK7 | .62 | 721A/8 | 17.98 | 5727 | 2.70 | | |
| 1J6 | .79 | 2J61 | 4.08 | 5Y3 | .43 | 6CG7 | 1.25 | 12SL7 | .82 | 723A/B | 17.98 | 5749 | 1.72 | | |
| 1J6 | .79 | 2J62 | 4.08 | 5Y4 | .43 | 6D4 | 2.48 | 12SQ7 | .64 | 724B | .98 | 5814 | 1.28 | | |
| 1L4 | .48 | 2K22 | 18.00 | 6A3 | .81 | 6E5 | 1.09 | 12SR7 | .68 | 725A | 8.94 | 5839 | 4.75 | | |
| 1LA4 | 1.01 | 2K25 | 39.50 | 6A4 | 1.01 | 6F5 | .76 | 12Z3 | .74 | 750TH | 32.85 | 5840 | 4.30 | | |
| 1LA6 | 1.01 | 2K28 | 39.50 | 6AB4 | .63 | 6F6 | .76 | 14N7 | 1.09 | 750TL | 32.85 | 5841 | 4.30 | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5875 | 2.05 | 6550 | 2.70 | 7193 | .74 | 8005 | 2.80 | 8298 | 5.98 | 9006 | .98 |
| 5881 | 2.70 | 6550 | .74 | 7199 | .81 | 8008 | 5.98 | 8299 | 6.45 | 9007 | .98 |
| 5910 | .74 | 6883 | 5.06 | 7232 | 5.06 | 8011 | 4.91 | 8417 | 6.45 | 9008 | .98 |
| 5932 | 5.06 | 6883 | 4.91 | 7241 | 4.91 | 8012 | 4.91 | 8423 | 6.45 | 9009 | .98 |
| 5933 | 4.91 | 6005 | 2.80 | 7242 | 4.91 | 8013 | 4.91 | 8425 | 6.45 | 9010 | .98 |
| 6080 | 5.98 | 6080 | 5.98 | 7243 | 4.91 | 8020 | .88 | 8438 | 6.45 | 9011 | .98 |
| 6146 | 3.98 | 6146 | 3.98 | 7247 | 4.91 | 8021 | .88 | 8441 | 6.45 | 9012 | .98 |
| 6161 | 1.58 | 6161 | 1.58 | 7360 | 4.91 | 8022 | .88 | 8442 | 6.45 | 9013 | .98 |
| 6176 | 6.45 | 6176 | 6.45 | 7361 | 4.91 | 8025 | .88 | 8443 | 6.45 | 9014 | .98 |
| 6201 | 2.99 | 6201 | 2.99 | 7363 | 4.91 | 8026 | .88 | 8444 | 6.45 | 9015 | .98 |
| 6202 | 24.95 | 6202 | 24.95 | 7364 | 4.91 | 8027 | .88 | 8445 | 6.45 | 9016 | .98 |
| 6203 | 24.95 | 6203 | 24.95 | 7365 | 4.91 | 8028 | .88 | 8446 | 6.45 | 9017 | .98 |
| 6005 | 4.07 | 6005 | 4.07 | 7366 | 4.91 | 8029 | .88 | 8447 | 6.45 | 9018 | .98 |
| 6012 | 4.91 | 6012 | 4.91 | 7367 | 4.91 | 8030 | .88 | 8448 | 6.45 | 9019 | .98 |
| 6013 | 4.91 | 6013 | 4.91 | 7368 | 4.91 | 8031 | .88 | 8449 | 6.45 | 9020 | .98 |
| 9001 | .88 | 9001 | .88 | 7369 | 4.91 | 8032 | .88 | 8450 | 6.45 | 9021 | .98 |
| 9002 | .88 | 9002 | .88 | 7370 | 4.91 | 8033 | .88 | 8451 | 6.45 | 9022 | .98 |
| 9003 | .98 | 9003 | .98 | 7371 | 4.91 | 8034 | .88 | 8452 | 6.45 | 9023 | .98 |
| 9004 | .98 | 9004 | .98 | 7372 | 4.91 | 8035 | .88 | 8453 | 6.45 | 9024 | .98 |
| 9006 | .98 | 9006 | .98 | 7373 | 4.91 | 8036 | .88 | 8454 | 6.45 | 9025 | .98 |

**CRYSTAL DIODES**

| | |
|---|---|
| 1N21 | .32 |
| 1N21A | .98 |
| 1N21B | 3.02 |
| 1N22 | .98 |
| 1N23 | .98 |
| 1N23A | 1.76 |
| 1N34A | .88 |
| 1N35 | .88 |
| 1N38 | 1.58 |
| 1N38A | 1.58 |
| 1N39 | 4.51 |
| 1N48 | 1.04 |
| 1N54 | .47 |
| 1N54 | .78 |
| 1N55 | .89 |
| 1N56 | 2.98 |

**C'RAY TUBES**

| | |
|---|---|
| 3AP1 | 5.11 |
| 3BP1 | 5.71 |
| 3CP1 | 1.98 |
| 3DP1 | 1.98 |
| 5CP1 | 2.98 |

## NEW AC & DRY BATTERY KIT



106 Watt Sec. Photoflash. Includes condensers, two 525MFD/480V/Total 105W/Sec. Resists. capacitors, rectifiers, flash tube in indicating flash gun, guide #40 on kodacturne. Does Not Incl. Batteries. AC Only..$35.98

FIVE (5) 90 VOLT (NOM) BATTERIES.....$12.50
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525MFD 480V/53W-Secs. Cond. new low inductance (non-POLARIZED)..$2; 2/$10
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16MFD/1.8 to 3.8KV/60W-Secs..$3; 2.50
CK5017 Mini. gas rectifier.....$1.98
600VAC Intermittent Rectifier.....$4.25
1600VDC Selenium Rectifier.....$2.50
Electronic Flash Handpack Ckt. Data..50¢

## POTO FLASH & STROBE LAMPS

| "TAB" No. | Replaces | W-Sec. Max. | Each |
|---|---|---|---|
| TLW | FA104/FT118 | 150 | $5.98 |
| TLX | AMG8/5804X | 100 | 3.98 |
| 218T | GE FT210 | 200 | 9.98 |
| THVA | SYLV. 4330 | 200 | 9.98 |
| THX4 | XP40 | 200 | 10.98 |
| TLX | DX8FA100 | 150 | 9.00 |
| TDX | DX5/250-350 | 150 | 10.00 |
| TSX | FT350GTQ | 2000 | 49.50 |

Trigger coil for HI&LO V Flash..1.47

Write for "TAB" Flash Tube Data....50¢

## VARIABLE VOLTAGE XFMRS

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| | |
|---|---|
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| 0-135V 5A | 11.95 |
| Cased 0-135V 7.5A | 21.95 |
| Uncased 0-135V 7.5A | 19.95 |
| Cased 0-270V 3A | 24.95 |
| Uncased 0-270V 3A | 18.95 |
| Cased 0-270V 5A | 41.95 |
| Cased 0-270V 9A | 61.95 |

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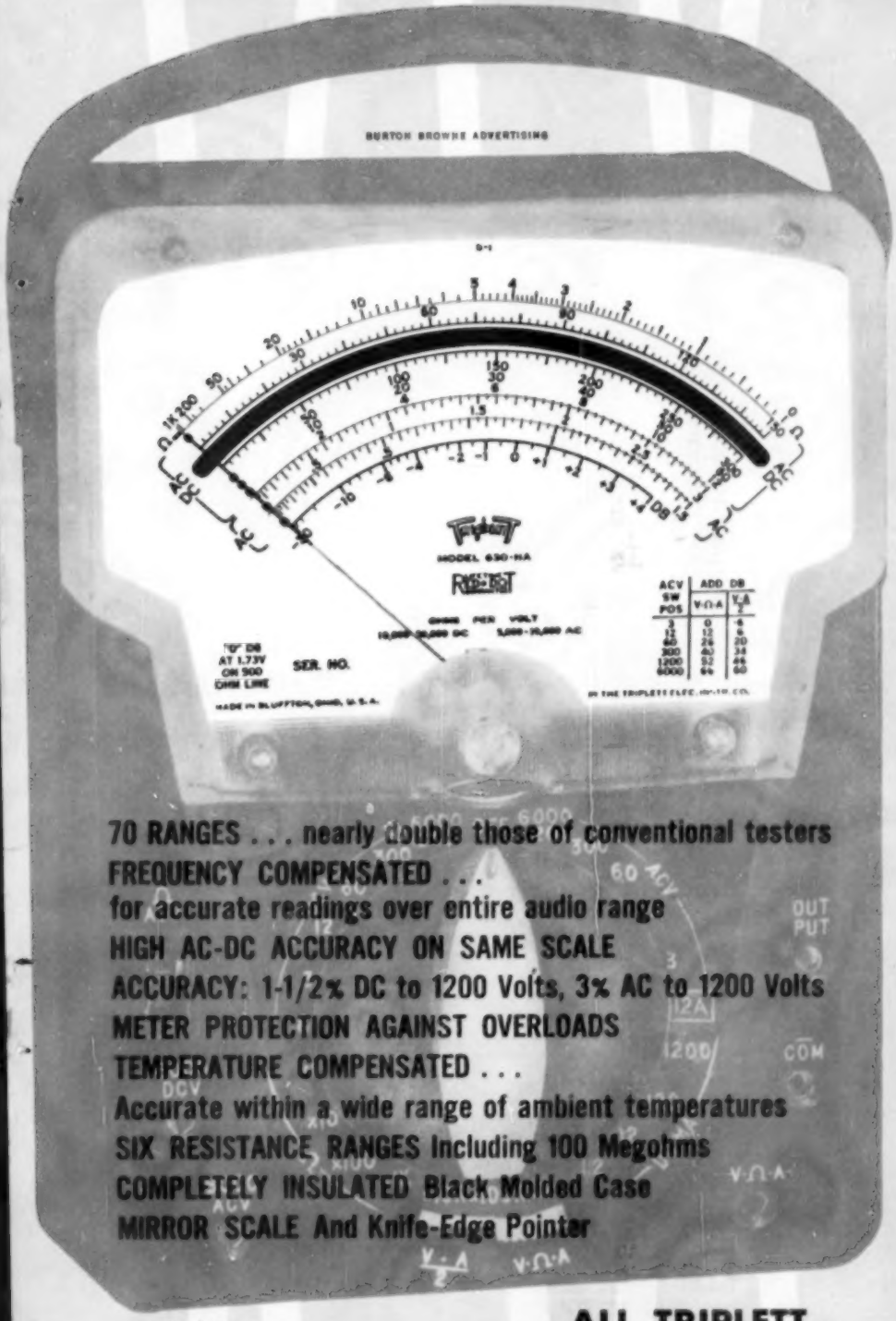
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| | | | | |
|---|---|---|---|---|
| 0.11Ω | $50 | $150 | $5000 | $25000 |
| 0.22 | 50 | 200 | 6000 | 30000 |
| 0.7 | 60 | 300 | 7000 | 35000 |
| 1.03 | 70 | 400 | 8000 | 40000 |
| 2.5 | 80 | 500 | 9000 | 45000 |
| 3 | 90 | 600 | 10000 | 50000 |
| 3.83 | 95 | 700 | 11000 | 55000 |
| 4 | 100 | 750 | 12000 | 60000 |
| 5 | 110 | 800 | 13000 | 65000 |
| 6 | 120 | 900 | 14000 | 70000 |
| 7 | 125 | 1000 | 15000 | 75000 |
| 8 | 130 | 1100 | 16000 | 80000 |
| 9 | 140 | 1200 | 17000 | 85000 |
| 10 | 150 | 1300 | 18000 | 90000 |
| 11 | 160 | 1400 | 19000 | 95000 |
| 12 | 170 | 1500 | 20000 | 100000 |
| 13 | 180 | 1600 | 21000 | 110000 |
| 14 | 190 | 1700 | 22000 | 120000 |
| 15 | 200 | 1800 | 23000 | 125000 |
| 16 | 210 | 1900 | 24000 | 130000 |
| 17 | 220 | 2000 | 25000 | 140000 |
| 18 | 230 | 2100 | 26000 | 150000 |
| 19 | 240 | 2200 | 27000 | 160000 |
| 20 | 250 | 2400 | 28000 | 170000 |
| 21 | 260 | 2500 | 29000 | 180000 |
| 22 | 270 | 2600 | 30000 | 190000 |
| 23 | 280 | 2700 | 31000 | 200000 |
| 24 | 290 | 2800 | 32000 | 210000 |
| 25 | 300 | 2900 | 33000 | 220000 |
| 26 | 310 | 3000 | 34000 | 230000 |
| 27 | 320 | 3100 | 35000 | 240000 |
| 28 | 330 | 3200 | 36000 | 250000 |
| 29 | 340 | 3300 | 37000 | 260000 |
| 30 | 350 | 3400 | 38000 | 270000 |
| 31 | 360 | 3500 | 39000 | 280000 |
| 32 | 370 | 3600 | 40000 | 290000 |
| 33 | 380 | 3700 | 41000 | 300000 |
| 34 | 390 | 3800 | 42000 | 310000 |
| 35 | 400 | 3900 | 43000 | 320000 |
| 36 | 410 | 4000 | 44000 | 330000 |
| 37 | 420 | 4100 | 45000 | 340000 |
| 38 | 430 | 4200 | 46000 | 350000 |
| 39 | 440 | 4300 | 47000 | 360000 |
| 40 | 450 | 4400 | 48000 | 370000 |
| 41 | 460 | 4500 | 49000 | 380000 |
| 42 | 470 | 4600 | 50000 | 390000 |
| 43 | 480 | 4700 | 51000 | 400000 |
| 44 | 490 | 4800 | 52000 | 410000 |
| 45 | 500 | 4900 | 53000 | 420000 |
| 46 | 510 | 5000 | 54000 | 430000 |
| 47 | 520 | 5100 | 55000 | 440000 |
| 48 | 530 | 5200 | 56000 | 450000 |
| 49 | 540 | 5300 | 57000 | 460000 |
| 50 | 550 | 5400 | 58000 | 470000 |
| 51 | 560 | 5500 | 59000 | 480000 |
| 52 | 570 | 5600 | 60000 | 490000 |
| 53 | 580 | 5700 | 61000 | 500000 |
| 54 | 590 | 5800 | 62000 | 510000 |
| 55 | 600 | 5900 | 63000 | 520000 |
| 56 | 610 | 6000 | 64000 | 530000 |
| 57 | 620 | 6100 | 65000 | 540000 |
| 58 | 630 | 6200 | 66000 | 550000 |
| 59 | 640 | 6300 | 67000 | 560000 |
| 60 | 650 | 6400 | 68000 | 570000 |
| 61 | 660 | 6500 | 69000 | 580000 |
| 62 | 670 | 6600 | 70000 | 590000 |
| 63 | 680 | 6700 | 71000 | 600000 |
| 64 | 690 | 6800 | 72000 | 610000 |
| 65 | 700 | 6900 | 73000 | 620000 |
| 66 | 710 | 7000 | 74000 | 630000 |
| 67 | 720 | 7100 | 75000 | 640000 |
| 68 | 730 | 7200 | 76000 | 650000 |
| 69 | 740 | 7300 | 77000 | 660000 |
| 70 | 750 | 7400 | 78000 | 670000 |
| 71 | 760 | 7500 | 79000 | 680000 |
| 72 | 770 | 7600 | 80000 | 690000 |
| 73 | 780 | 7700 | 81000 | 700000 |
| 74 | 790 | 7800 | 82000 | 710000 |
| 75 | 800 | 7900 | 83000 | 720000 |
| 76 | 810 | 8000 | 84000 | 730000 |
| 77 | 820 | 8100 | 85000 | 740000 |
| 78 | 830 | 8200 | 86000 | 750000 |
| 79 | 840 | 8300 | 87000 | 760000 |
| 80 | 850 | 8400 | 88000 | 770000 |
| 81 | 860 | 8500 | 89000 | 780000 |
| 82 | 870 | 8600 | 90000 | 790000 |
| 83 | 880 | 8700 | 91000 | 800000 |
| 84 | 890 | 8800 | 92000 | 813000 |
| 85 | 900 | 8900 | 93000 | 820000 |
| 86 | 910 | 9000 | 94000 | 830000 |
| 87 | 920 | 9100 | 95000 | 840000 |
| 88 | 930 | 9200 | 96000 | 850000 |
| 89 | 940 | 9300 | 97000 | 860000 |
| 90 | 950 | 9400 | 98000 | 870000 |
| 91 | 960 | 9500 | 99000 | 880000 |
| 92 | 970 | 9600 | 100000 | 890000 |
| 93 | 980 | 9700 | 110000 | 900000 |
| 94 | 990 | 9800 | 120000 | 910000 |
| 95 | 1000 | 9900 | 130000 | 920000 |
| 96 | 1100 | 10000 | 140000 | 930000 |
| 97 | 1200 | 11000 | 150000 | 940000 |
| 98 | 1300 | 12000 | 160000 | 950000 |
| 99 | 1400 | 13000 | 170000 | 960000 |
| 100 | 1500 | 14000 | 180000 | 970000 |
| 101 | 1600 | 15000 | 190000 | 980000 |
| 102 | 1700 | 16000 | 200000 | 990000 |
| 103 | 1800 | 17000 | 210000 | 1MEG |
| 104 | 1900 | 18000 | 220000 | 1.1 |
| 105 | 2000 | 19000 | 230000 | 1.2 |
| 106 | 2100 | 20000 | 240000 | 1.3 |
| 107 | 2200 | 21000 | 250000 | 1.4 |
| 108 | 2300 | 22000 | 260000 | 1.5 |
| 109 | 2400 | 23000 | 270000 | 1.58 |
| 110 | 2500 | 24000 | 280000 | 1.6 |
| 111 | 2600 | 25000 | 290000 | 1.7 |
| 112 | 2700 | 26000 | 300000 | 1.78 |
| 113 | 2800 | 27000 | 310000 | 1.8 |
| 114 | 2900 | 28000 | 320000 | 1.9 |
| 115 | 3000 | 29000 | 330000 | 2 |
| 116 | 3100 | 30000 | 340000 | 2.05 |
| 117 | 3200 | 31000 | 350000 | 2.1 |
| 118 | 3300 | 32000 | 360000 | 2.2 |
| 119 | 3400 | 33000 | 370000 | 2.3 |
| 120 | 3500 | 34000 | 380000 | 2.4 |
| 121 | 3600 | 35000 | 390000 | 2.5 |
| 122 | 3

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70 RANGES . . . nearly double those of conventional testers
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